- Removal of dead wood and dead trees.
- Climate change (human-caused)

Consideration of these KTPs is provided as part of the Assessments of Significance completed by Niche (2014a) for the subject species and summarised in Section 4.7.5.7.

4.7.5.6 Critical Habitat

Critical habitat has not been declared under the TSC Act or EPBC Act for any species, population or community that occurs within the Stage 2 Site.

4.7.5.7 Impacts on Threatened Species

The following sections consider the magnitude, extent and significance of the Proposal on the subject species (see Section 4.7.3.3). The significance of the impacts have been assessed by Niche (2014a) based on:

- the importance of individual species, populations and/or plants and/or subpopulations that are likely to be affected by the Proposal in maintaining the long-term viability of the species, population or ecological community; and
- the importance of habitat features that are likely to be affected by the Proposal in maintaining the long-term viability of the species, population or ecological community.

  The following provides an overview of the Assessments of Significance completed by Niche (2014a) (which can be viewed in full as *Appendices 10* and *11* of Niche, 2014a).

Threatened Flora

Impacts on threatened flora are restricted to removal of 751 individual Silver-leafed Mountain Gum plants (631 of which occur in unnatural habitat). Niche (2014a) confirms that the Proposal would have a significant impact which would be adequately offset by the conservation and protection of (at least) 1 850 individuals and core natural habitat within the proposed BOA. No other significant impacts on threatened flora are considered likely.

As noted in Section 2.15.3, an alternative extraction area extension was initially considered by the Applicant (see **Figure 2.12**). This extraction area would have required a slightly larger impact footprint and therefore provide a slightly larger life of quarry resource. By modifying the limit of extraction, however, a number of identified Silver-leafed Mountain Gum plants would be avoided (see **Figure 4.39**). It would be impractical to modify the limit of extraction further to avoid additional Silver-leafed Mountain Gum plants.

Threatened Fauna

Impacts to threatened fauna as a result of the Stage 2 Extension would occur through the removal of native vegetation which provides foraging, breeding or roosting habitat. For example, roosting, torpor and breeding activities of threatened tree-roosting bats may be impacted by the clearing of hollow-bearing trees. Nesting and breeding activities for threatened

birds, e.g. Scarlet Robin, could also be disturbed by clearing activities leading to abandonment of nest sites or loss of fledgling chicks. In each case, the surrounding areas to the Stage 2 Site contain significant areas of equivalent habitat into which each of the subject species considered has the capacity to relocate or use in preference to the Stage 2 Site.

4.7.5.8 Groundwater Dependent Ecosystems

Figure 4.38 provides site validated mapping of the occurrence and distribution of terrestrial GDEs based on mapped vegetation units. Of the mapped vegetation, Niche (2014a) reports that only the River Oak riparian forest along Coxs River is reliant on water availability for survival. Niche (2014a) considers that seasonal flows and storm surges are more likely to determine the viability of vegetation along the Coxs River than the availability of groundwater base flows. Small changes to groundwater availability (such as to base flows) would not significantly impact the River Oak riparian forest along the Coxs River.

Section 4.8.5.2 provides further discussion of potential impacts to sub-surface GDEs.

4.7.5.9 Cumulative Impacts

The Austen Quarry is largely isolated from other extractive industry, mining or similar development with no other equivalent development occurring within 15km of the Stage 2 Site (see **Figure 4.40**). Furthermore, all disturbance associated with the Proposal has been identified and accounted for when considering impacts on biodiversity. The only potential for cumulative impacts on biodiversity therefore, is if considered against the major contributor to vegetation clearing in the region, agriculture. Given the vastly different scales of impact between the Proposal and historic agriculture, the most appropriate approach to assessing cumulative impact is through an assessment of impact on habitat corridors and threatened species population viability.

Section 4.7.5.4 considers the effect of the Proposal on local habitat corridors, and while there would be a reduction in the width of habitat connectivity to the south of the extraction area, a viable corridor would be retained. Furthermore, the rehabilitation of the extraction area and overburden emplacement, and establishment of a BOA, would ultimately reinstate and provide for the long-term conservation of this habitat corridor.

With respect to impacts on threatened species, it is noted that the assessments of the significance conducted by Niche (2014a) do not consider the impacts of the Proposal on each species in isolation. Causes of local or regional decline, such as increased clearing or other factors influenced by development, are necessarily considered. Furthermore, the proposed BOA has been developed in accordance with the BBAM, which takes into consideration catchment and state wide issues, including proportional clearance, associated with different vegetation and habitat types.

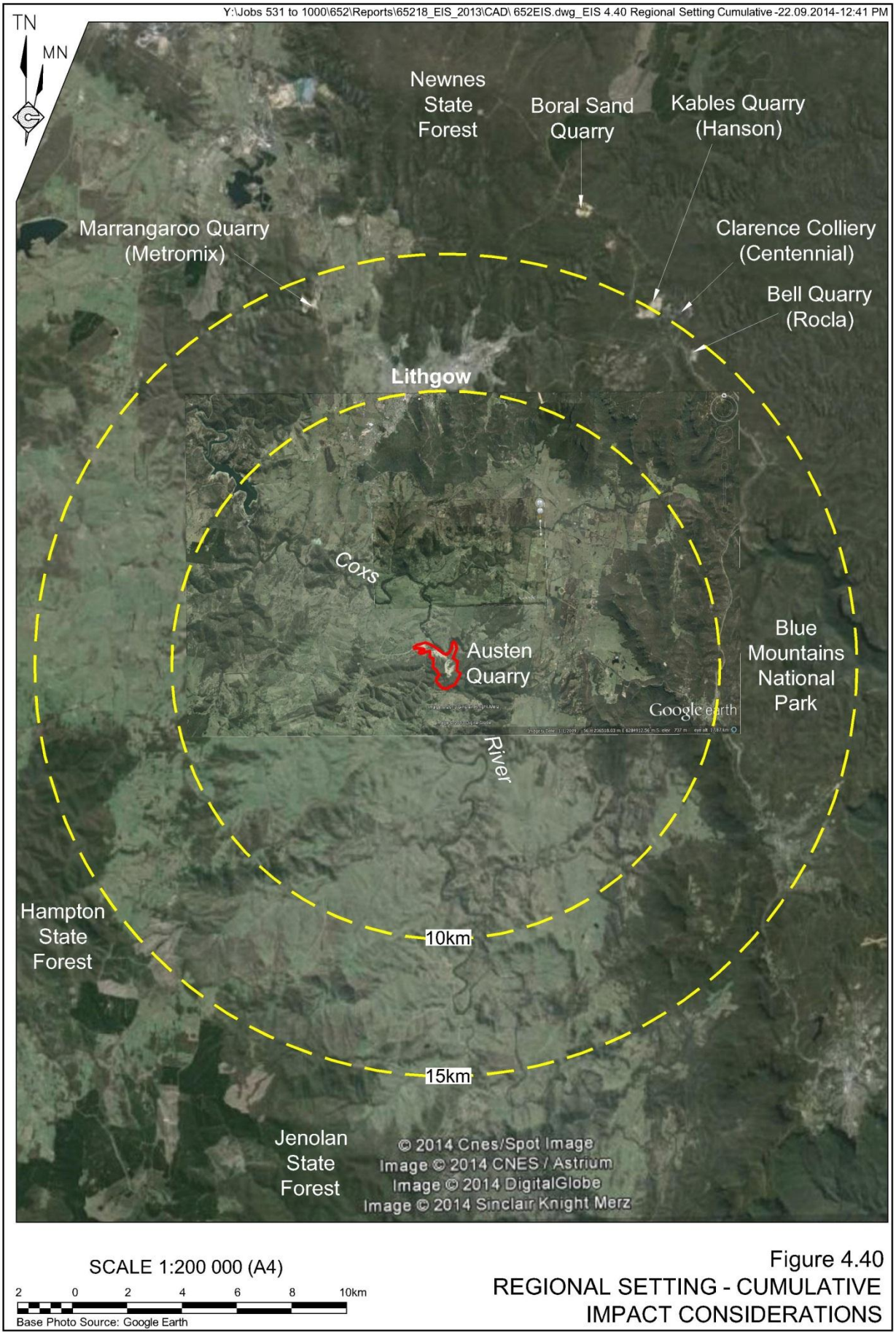


Figure 4.40
REGIONAL SETTING - CUMULATIVE IMPACT CONSIDERATIONS

4.7.5.10 Conclusion

Niche (2014a) conclude that the Proposal is unlikely to have a significant impact on subject threatened species, except for Silver-leafed Mountain Gum. Niche (2014a) clearly demonstrates that the proposed BOA will achieve an 'improve or maintain' outcome in relation to Silver-leafed Mountain Gum under both State and Commonwealth offsetting policies and guidelines. Residual impacts to native vegetation will also be adequately offset within State and Commonwealth policies and guidelines.

4.8 AQUATIC ECOLOGY

4.8.1 Introduction

The DGRs issued for the Proposal identified "*Biodiversity*" as a key issue incorporating some elements of aquatic ecology that will be assessed in the following subsections. The DGRs require that the "*EIS include a quantitative assessment of the potential:*

- *impacts of the development on any terrestrial or aquatic threatened species or populations and their habitats, endangered ecological communities and groundwater dependent ecosystems; and*

Additional matters for consideration in preparing the EIS were also provided in the correspondence attached to the DGRs from DTIRIS which related to aquatic habitat protection requirements and can be briefly summarised as including:

- a series of general requirements for assessing the impact to the aquatic environment including identifying existing and likely populations, aquatic habitat descriptions and existing aquatic environment uses;
- considerations for assessing
  - dredging and reclamation works,
  - activities that may damage marine vegetation;
  - activities that may block fish passage;
  - threatened aquatic species; and
  - impacts to fishing and aquaculture. And
- ensuring appropriate management of riparian buffer zones

Based on the risk analysis undertaken for the Proposal (Section 3.3.1 and **Table 3.9**), the potential impacts relating to aquatic ecology and their risk rankings (in parenthesis) after the adoption of pre-existing or standard mitigation measures are as follows.

- Pollution of local waterways resulting in detrimental effects to flora and fauna (Medium Risk).
- Reduced local distribution of threatened species, populations and endangered ecological communities (Medium Risk).
- Degradation of riparian or aquatic vegetation / ecosystems (Low to Medium Risk).

- Sedimentation or hydrocarbon pollution event impacting on aquatic ecosystem (temporary to long term impact (Low to Medium Risk).
- Degradation of groundwater dependent ecosystems (Low Risk).

A review of the attributed risk levels, following the adoption of the recommended operational safeguards and controls, is provided in Section 6.2.1 and **Table 6.1**.

An aquatic ecology assessment for the Proposal was completed by Mr Max Best of Cardno Ecology Lab ("Cardno"). The assessment is presented as Part 5 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Cardno (2014)". This subsection of the EIS provides a summary of the aquatic ecology assessment, concentrating on those matters raised in the DGRs and related requirements provided by various government agencies. A consolidated list of the identified requirements and where each is addressed is presented in **Appendix 3**.

4.8.2 Assessment Methodology

4.8.2.1 Desktop Assessment (Identification of Issues of Conservation Significance)

In order to assess the potential impacts of the Proposal on aquatic ecology, Cardno (2014) established the issues of conservation significance that would be, or could be affected by the current and proposed operations on the Stage 2 Site. This was achieved through a review of NSW and Commonwealth databases and associated literature (e.g. catchment studies, assessment guidelines and relevant monitoring programs). A complete description of this reference material reviewed and its application to the Proposal is provided by *Section 3* of Cardno (2014), an overview of which is as follows.

Matters of National Environmental Significance (Commonwealth EPBC Act)

Cardno (2014) used the Protected Matters Search Tool, a database maintained by the Department of the Environment (DOE), to identify threatened aquatic species and communities listed under the EPBC Act that occur or may occur in the Lithgow City LGA. This search included the entire LGA to ensure that mobile, threatened species that may periodically move into areas affected by the Proposal were taken into consideration.

Cardno (2014) also reviewed the Key Threatening Processes (KTPs) listed under the EPBC Act for relevance to the Proposal.

Matters of NSW Environmental Significance (TSC Act / FM Act)

Cardno (2014) completed a search of the online Record Viewer developed by the Threatened Species Unit of the former I&I NSW for information regarding records and distribution of threatened and protected species of fish in the Lithgow City LGA and Hawkesbury-Nepean CMA. Cardno (2014) also completed a search of the NSW BioNet (managed by OEH) for records of threatened flora and fauna sightings within Lithgow City LGA held in the Atlas of NSW Wildlife as well as information on known and predicted distributions of vegetation communities, endangered populations and key threatening processes listed under the TSC Act occurring within the Lithgow City LGA.

Cardno (2014) also reviewed the TSC Act and FM Act in order to identify KTPs or critical aquatic habitats relevant to, or potentially impacted by the Proposal.

Groundwater Dependent Ecosystems (GDEs)

Cardno (2014) reviewed the *Risk Assessment Guidelines for GDEs* produced by the NSW Office of Water (Serov et al. 2012) to establish the type of GDEs that could be affected by the Proposal. Cardno (2014) established that the Proposal could potentially impact on two GDEs, namely:

- Base flow streams (surface water ecosystems); and
- Sub-surface phreatic aquifer ecosystems.

To assess the potential for surface GDEs on or adjoining the Stage 2 Site, Cardno (2014) accessed the Atlas of GDEs maintained by the Bureau of Meteorology (BoM). This database uses spatial environmental data to indicate potential interaction between groundwater and both terrestrial vegetation communities (phreatophytes) and surface aquatic ecosystems (base flow streams).

As the Atlas of GDEs does not provide information on sub-surface GDEs, Cardno (2014) referred to recent literature on sub-surface aquifer ecosystems (Humphreys 2006, Eberhard et al. 2007, Hancock and Boulton 2008, Pryce et al. 2010, Tomlinson and Boulton 2010, Serov et al. 2012) and applied this to local hydrogeological conditions (as described by Ground Doctor, 2014) (refer to Section 4.12.2).

Cardno (2014) also considered Schedule 4 of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources area (Coxs River Fractured Rock groundwater source), however, none of the listed GDEs occurs within or adjacent to the Stage 2 Site.

4.8.2.2 Field Survey and Establishment of Local Aquatic Conditions

Cardno (2014) reviewed historic sampling and analysis of local conditions within the Coxs River undertaken in accordance with the NSW Australian Rivers Assessment System (AUSRIVAS) sampling methods (Turak et al. 2004) since 2005. Cardno (2014) also undertook additional sampling and analysis (of aquatic fauna and water quality) in September 2013.

The sites sampled between 2005 and 2011 are paired sites situated at four locations on the Coxs River spread between Glenroy Bridge and Duddawarra Bridge (approximately 2.5km north and 5km south of the Stage 2 Site respectively). The sites sampled in 2013 were chosen to complement the long-term monitoring sites, as well as provide information on catchments not previously sampled or assessed. **Figure 4.41** identified the locations of the sites sampled and analysed by Cardno (2014).

On the basis of the historic and 2013 sampling and analyses, Cardno (2014) compared electrical conductivity (EC), dissolved oxygen (DO), pH and turbidity measurements with the upper and lower default trigger values (DTVs) for slightly disturbed rivers in south-east Australia (ANZECC/ARMCANZ, 2000). These trigger values provide an indication of risk to environmental value, with measurements within the upper and lower DTV range indicative of a low risk and those outside the range indicating that the environmental value may not be protected. The aquatic flora, fauna, water quality and other conditions of each site sampled were also analysed by Cardno (2014) in order to assign a Fish Habitat Type (in accordance with the *Fish Habitat Assessment Criteria* of DPI, 2013) and Class (in accordance with the *Riparian, Channel and Environmental (RCE) method* of Chessman et al. 1997), and assess aquatic fauna against AUSRIVAS reference conditions.

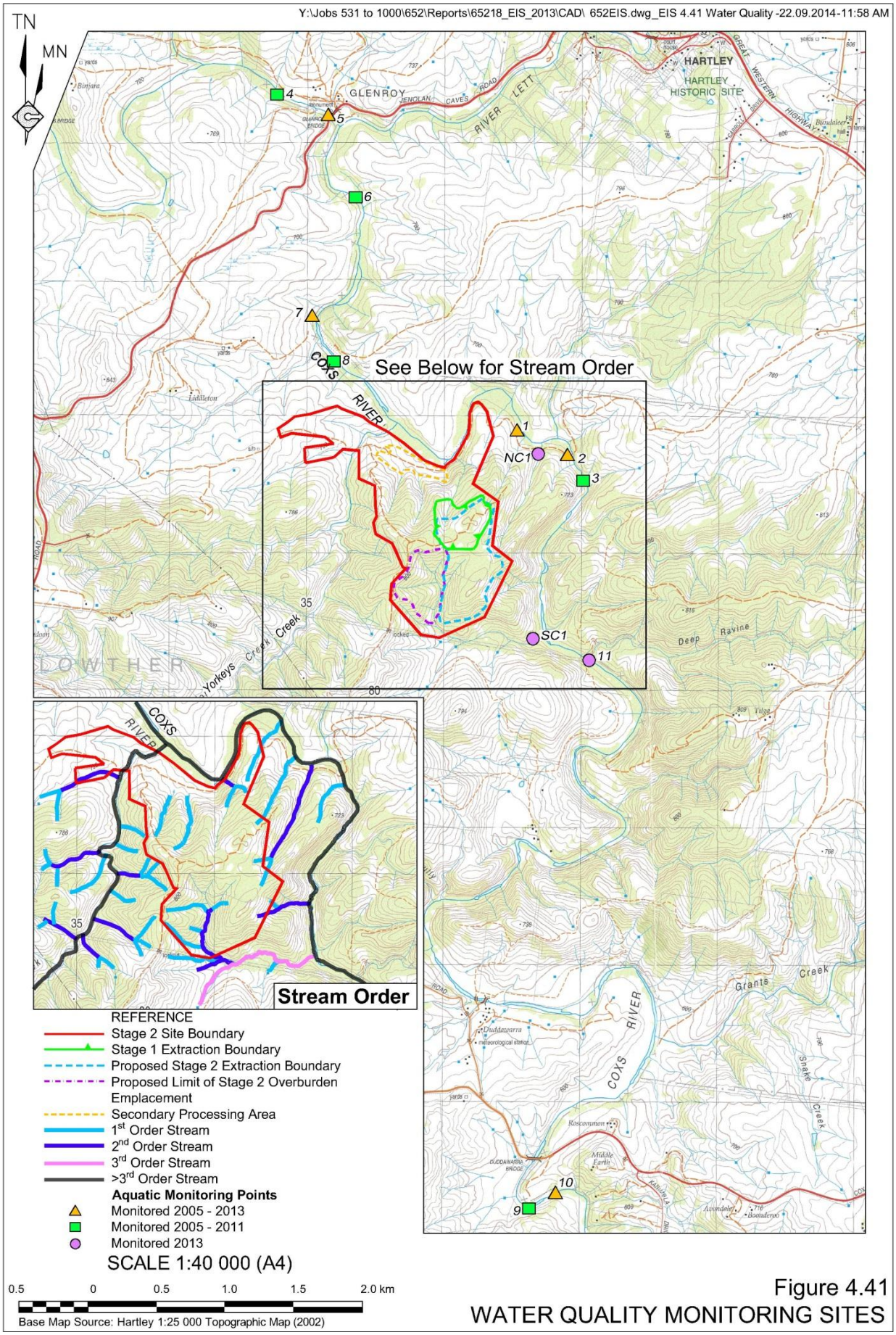


Figure 4.41
WATER QUALITY MONITORING SITES

4.8.2.3 Identification of Potential Impacts, Review of Mitigation Measures and Assessment of Likely Impact

Having established the local conditions on which the Proposal could impact, Cardno (2014) carefully reviewed the proposed activities to establish the potential impacts of the Proposal on the receiving aquatic environment.

The potential impacts were considered for the following phases of the Proposal.

- Development – including access preparation, vegetation clearing, soil and overburden stripping and erosion and sediment control installation.
- Operation – including the various resource extraction, processing, overburden management and dewatering activities.
- Decommissioning and Rehabilitation – including plant decommissioning, final landform preparation and revegetation.

Notably, these phases are likely to be undertaken concurrently (but in different sections of the Stage 2 Site) throughout the life of the Proposal.

Impact avoidance, mitigation and management measures were recommended by Cardno (2014) and on the assumption that these would be implemented completed an assessment of the likely impact of the Proposal on aquatic ecology.

Cardno (2014) also completed a specific assessment of significance for those threatened species and KTPs identified as potentially impacted or enhanced as a result of the Proposal.

4.8.3 Local Setting

4.8.3.1 Local Catchments

The Stage 2 Site is located within the Mid Coxs River catchment of the Hawkesbury-Nepean catchment. CSIRO Land and Water (2000) identifies the majority of this catchment as highly degraded as a result of extensive clearing and modification to some creeks by urban developments. Notably, the flow regime of the section of the Coxs River within which the Stage 2 Site is located has been impacted by land clearing, regional climatic variations, and the construction and operation of Lyell Dam (CSIRO Land and Water, 2000). Hydrological data analysed by Cardno (2014) identify that the volume of water flowing within the Coxs River is highly variable and while regulated by Lake Wallace and Lake Lyell upstream of the Stage 2 Site, which impound water for the City of Lithgow and Wallerawang Power Station, there are periods of far higher flows coinciding with high rainfall or flood events. The substantial increase in discharge would likely influence the aquatic environment and biota, particularly in the weeks and months after these events (Cardno, 2014).

A more detailed description of the regional, local and Stage 2 Site catchments is provided in Section 4.5.2 and **Figures 4.29**, **4.30** and **4.31**.

4.8.3.2 Issues of Conservation Significance

4.8.3.2.1 Threatened Species, Populations and Communities

Following a review of the databases and literature noted in Section 4.6.2.1, Cardno (2014) determined that of the nine species listed under the TSC Act, FM Act and EPBC Act as potentially occurring within the vicinity of the Stage 2 Site, only one could reasonably be expected to occur (Macquarie Perch) (see **Table 4.26**).

Table 4.26
Threatened Species Potentially Occurring within the Site

Species name	TSC Act	FM Act	EPBC Act	Likelihood of occurrence
Australian Grayling			Vulnerable	Unlikely
Murray Cod			Vulnerable	Unlikely
Trout Cod		Endangered		Unlikely
Silver Perch		Vulnerable		Unlikely
Macquarie Perch		Endangered	Endangered	**Possible**
Adams Emerald Dragonfly		Endangered		Unlikely
Sydney Hawk Dragonfly		Endangered		Unlikely
Giant Dragonfly	Endangered			Unlikely
Source: Modified after Cardno (2014) – Table 3-1.				

No threatened ecological community listed under the EPBC Act, TSC Act or FM Act occur on, adjacent to, or immediately downstream of the Stage 2 Site.

Three threatened populations of freshwater fish are listed under the FM Act, however, the distribution range of these does not include the Coxs River of Yorkeys Creek. No threatened populations of aquatic organisms are listed under the TSC Act.

No critical aquatic habitats listed under the TSC Act or FM Act are found on, adjacent to or immediately downstream of the Stage 2 Site.

4.8.3.2.2 Key Threatening Processes

The KTPs listed under the EPBC Act, TSC Act and FM Act that may be relevant to the impact of the Proposal on aquatic ecology are as follows.

- *Fisheries Management Act 1994.*
  - Degradation of native riparian vegetation along New South Wales watercourses; and
  - In-stream structures and other mechanisms that alter natural flows.
- *Threatened Species Conservation Act 1995.*
  - Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
- *Environment Protection and Biodiversity Conservation Act 1999.*
  - Novel biota and their impact on biodiversity.

4.8.3.2.3 Groundwater Dependent Ecosystems

Surface GDEs

According to the BoM Atlas of GDEs, the Coxs River and Yorkeys Creek are surface water ecosystems with a moderate to high potential for groundwater interaction (see **Figure 4.41**). These ecosystems are likely to receive some base flow from the surface expression of groundwater.

The BoM Atlas of GDEs also identifies, at a coarse desktop level, vegetation communities with a moderate to high potential for groundwater interaction. Niche (2014a) has reviewed the vegetation of the Site and surrounds, with reference to the validated vegetation mapping of **Figure 4.38**, and refined the desktop level assessment of the BoM Atlas of GDEs. Niche (2014a) confirms that only the River Oak riparian forest vegetation community which occurs within the Coxs River riparian zone, equivalent to the areas noted in the BoM Atlas of GDEs as having high potential for groundwater interaction (see **Figure 4.42**), could be influenced by changes to local base flows. Niche (2014a) note further, however, that seasonal flows and storm surges during high rainfall events are likely to be far more deterministic of the condition of this vegetation than base flows of groundwater.

Cardno (2014) also notes that *Angophora floribunda* is dominant along the 2nd order watercourse upstream of NC1 (see **Figure 4.41**) and the associated community (C4: Rough-barked Apple gully forest) also has the potential to be groundwater dependent (see **Figure 4.42**).

Sub-surface GDEs

Cardno (2014) reports that sub-surface GDEs, such as hyporheic fauna (fauna inhabiting water in the hyporheic zone - the area of interaction between surface and groundwater) and stygofauna (groundwater dwelling organisms), have the potential to occur within and surrounding the Stage 2 Site.

- Hyporheic habitat is usually associated with stream beds that maintain subterranean flow. As discussed in Section 4.6.5, the Proposal is not predicted to impact on groundwater flows at a distance of 225m from the extraction area and therefore hyporheic habitat, if presented adjacent to the Coxs River, would not be affected.
- Stygofauna can inhabit a variety of subterranean habitats, however, are unlikely to occur within the rhyolite hosted aquifer as this has low porosity (0.7%) and is isolated from surrounding groundwater by the adjacent gullies, creeks and Coxs River (Ground Doctor, 2014). If present, stygofauna are most likely to occur within perched aquifers, which are unlikely within the rhyolite hosted aquifer to be impacted due to the homogeneity of the local geology, or within alluvium, which would not be affected by the Proposal.

It is concluded that the potential for stygofauna to be present is very low.

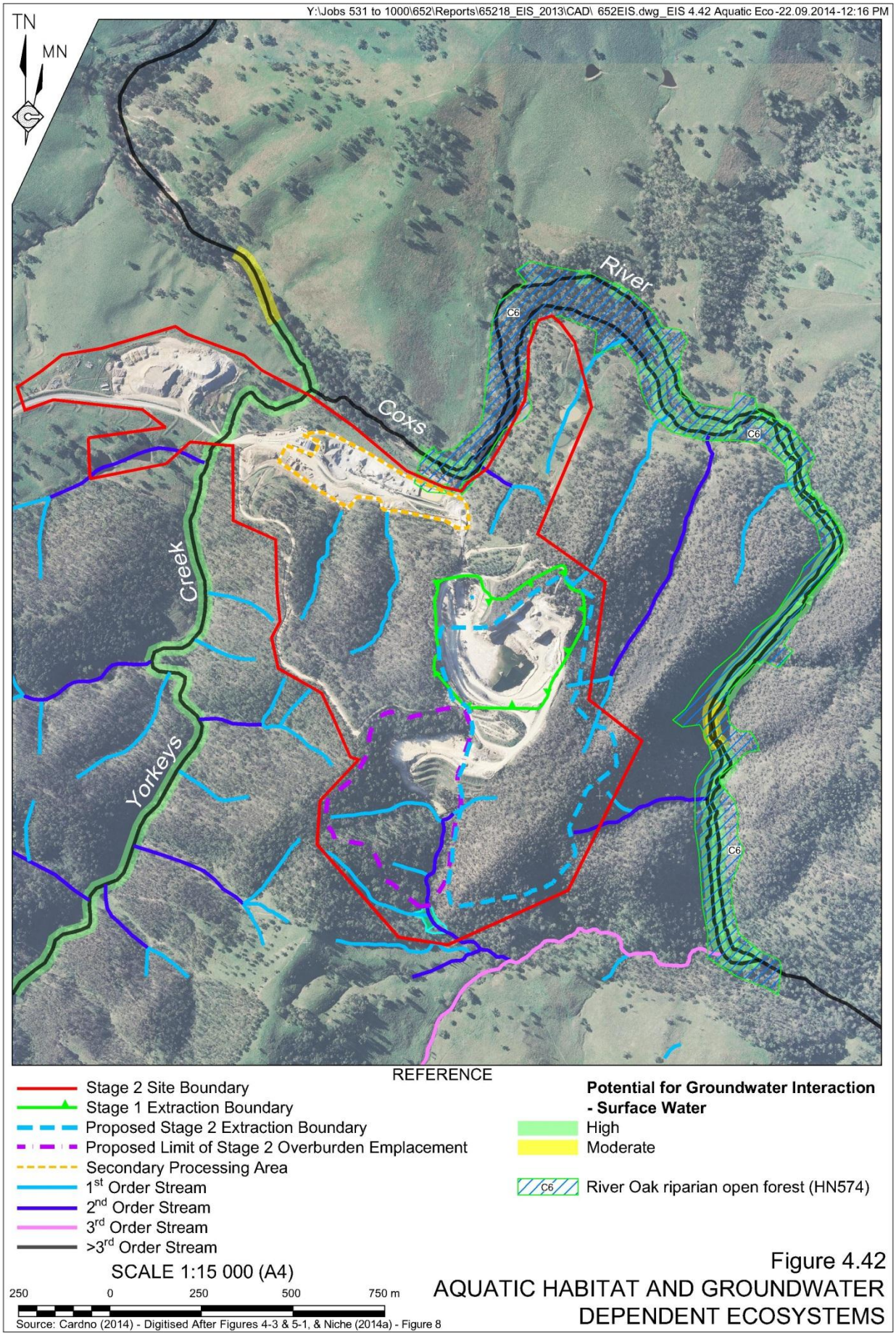


Figure 4.42
AQUATIC HABITAT AND GROUNDWATER DEPENDENT ECOSYSTEMS

4.8.3.3 Aquatic and Water Quality Conditions

Section 4 of Cardno (2014) provides a detailed review of the aquatic flora, fauna, habitat and water quality within the receiving environment. **Tables 4.27** to **4.29** provide a summary of the local conditions derived from the field sampling and analyses completed by Cardno and others since 2005.

Table 4.27
Water Quality

Location *	Electrical Conductivity	pH	Dissolved Oxygen	Turbidity
Upstream Control (Coxs)	↑	↑	↓	✓
Quarry Control (Coxs)	↑	✓	↓	✓
Quarry Treatment (Coxs)	↑	✓	↓	✓
Downstream Control (Coxs)	↑	✓	↓	✓
North Tributary (NC1)	✓	✓	↓	↑
South Tributary (SC1)	↑	✓	↓	↑

* Refer to **Figure 4.40.**
↑ = Median values above the relevant ANZECC/ARMCANZ (2000) guidelines.
↓ = Median values below the relevant ANZECC/ARMCANZ (2000) guidelines.
✓ = Median values within the target range of the relevant ANZECC/ARMCANZ (2000) guidelines.
Shaded cells represent poorer water quality.

Source: Modified after Cardno (2014) – Table 4-3.

Table 4.28
Aquatic Habitat Characteristics

Location *	Riparian Channel Environment Score	Fish Habitat Sensitivity (Type)	Fish Habitat Class (Class)
Upstream Control (Coxs)	41	1	1
Quarry Control (Coxs)	41	1	1
Quarry Treatment (Coxs)	43	1	1
Downstream Control (Coxs)	42	1	1
North Tributary (NC1)	35	N/A	3
South Tributary (SC1)	35	3	3

* Refer to **Figure 4.40.**
Shaded cells represent poorer habitat.

Source: Modified after Cardno (2014) – Table 4-4.

Notably, the receiving environment at all locations fell outside the ANZECC/ARMCANZ (2000) targets for at least one of the parameters measured, indicative of a catchment which has been subject to relatively high levels of disturbance and modification (refer to Section 4.6.3.1).

The modified Riparian Channel Environment (RCE) scores (after Chessman *et al.* 1997) indicate the aquatic habitat in the Coxs River was in a better overall condition than in the tributary creeks. All sites on the Coxs River were considered highly sensitive, major fish habitat, whereas the tributary sites generally did not contain important fish habitat.

Aquatic macroinvertebrate fauna and fish indicators for the Coxs River suggest the river in the vicinity of the Stage 2 Site is in good condition and conducive to a positive fauna assemblage.

Table 4.29
Aquatic Fauna Characteristics

Location *	Macroinvertebrate		Fish
	OE50 taxa (edge)	OE50 taxa (riffle)	
Upstream Control (Coxs)	Band A	Band A	✓
Quarry Control (Coxs)	Band A	Band A	✓
Quarry Treatment (Coxs)	Band A	Band A	✓
Downstream Control (Coxs)	Band A	Band B	✓
North Tributary (NC1)	N/A	N/A	N/A
South Tributary (SC1)	N/A	N/A	N/A
* Refer to **Figure 4.40.** Band A = Equivalent to reference condition. Band B = Below (but not well below) reference condition. ✓ = native fish present. Shaded cells represent poorer assemblage.			
Source: Modified after Cardno (2014) – Table 4-5			

4.8.4 Potential Impacts and Avoidance, Mitigation and Management Measures

4.8.4.1 Introduction

The following subsections provide a summary of the potential impacts of the Proposal on local aquatic conditions, habitats or species along with the impact avoidance, mitigation and management measures to be adopted by the Applicant. Section 4.6.5 provides an overview of the likely residual impacts considering the adoption of these.

4.8.4.2 Land Preparation

Land preparation refers to the activities such as vegetation clearing and soil stripping and management undertaken in preparation for major earthworks, i.e. overburden removal and extraction of rhyolite.

Potential Impacts

The development of the extraction area and overburden emplacement could result in the following impacts.

- Discharge of sediment or nutrient-laden runoff from cleared areas, including access tracks and roads into watercourses.
- Subsequent alteration to the benthic sub-stratum of the receiving waters, smothering of aquatic habitats and increase turbidity levels (leading to decreased photosynthesis by aquatic plants and other impacts on aquatic fauna).
- Accidental release of lubricating oils, hydraulic fluids or fuel from earthmoving equipment could result in the input of toxic hydrocarbons into the creeks and their watercourses.

Avoidance, Mitigation and Management Measures

Following from the recommendations of Cardno (2014), the following impact avoidance, mitigation and management measures would be implemented.

- Areas of riparian zone and aquatic habitat disturbed would be restricted to those within the impact footprint of the Stage 2 Extension.
- Should development works, e.g. access roads, be required in the vicinity of watercourses, these would be designed and completed in accordance with the NSW DPI Policy and *Guidelines for Fish Habitat Conservation and Management* (DPI, 2013).
- An Erosion and Sediment Control Plan (ESCP) would be prepared for the Proposal as part of the *Water Management Plan*. Prepared in accordance with DECC (2008b), the ESCP would delineate the limits to disturbance noted above and provide the locations, designs and maintenance requirements for structures aimed at preventing discharge of sediment or nutrient-laden water.
- Temporary erosion and sediment control measures such as sediment fences, sandbag weirs, temporary drains, and temporary silt traps would be installed prior to any construction works.
- Discharge of water would be managed in accordance with the recommendations of Groundwork Plus (2014). These strategies, aimed at minimising the potential for uncontrolled discharges to the Coxs River and Yorkeys Creek, are discussed further in Section 4.5.4.
- A bunded area for storage of fuels, oils, refuelling and appropriate maintenance of vehicles and mechanical plant would be maintained within the Administration Area.
- Re-fuelling, washing and maintenance of vehicles and plant within 30m the Coxs River and its watercourses would be prohibited.
- Any spillages or leaks would be immediately reported and spill containment response immediately enacted to restrict the spread into or within watercourses.

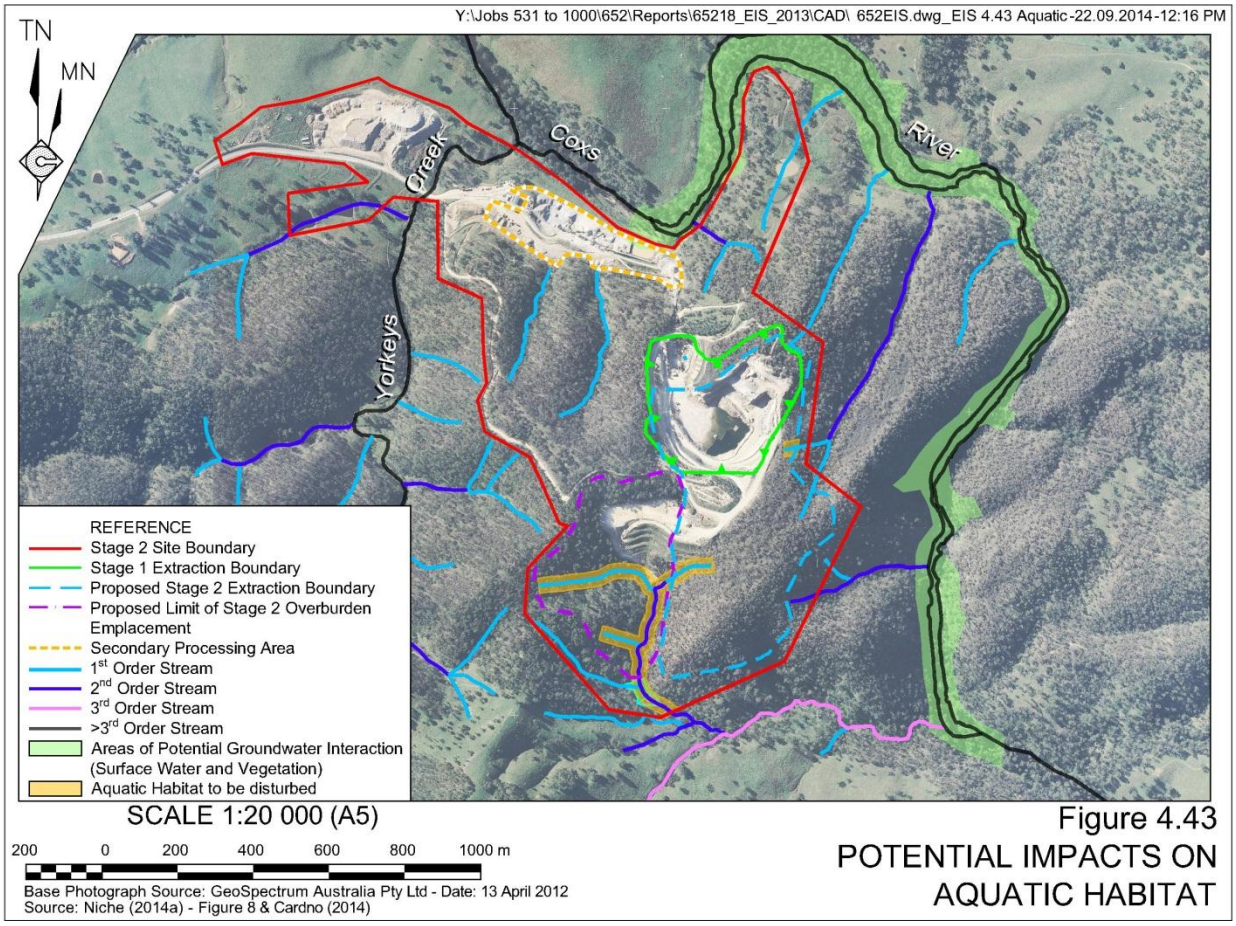
4.8.4.3 Quarry Operation

4.8.4.3.1 Resource Extraction and Overburden Emplacement

Potential Impacts

The extension of the extraction area and overburden emplacement would result in the direct removal or backfilling aquatic habitat contained within 1st and 2nd order streams in the upper reaches of the Coxs River North and South Catchments (see **Figure 4.43**) resulting in:

- the loss of approximately 800m of aquatic habitat associated with the 1st and 2nd order streams;
- the loss of any aquatic flora and fauna resident within this habitat; and
- discharge of water with elevated sediment loads as a result of erosion from the overburden emplacement.



Avoidance, Mitigation and Management Measures

No specific measures are available to avoid the loss of approximately 800m of aquatic habitat and associated aquatic flora and fauna from the upper reaches of the North and South Catchment tributary. Following from the recommendations of Cardno (2014), the following impact mitigation and management measures would be implemented.

- Areas to disturbed would be restricted to those within the impact footprint of the Stage 2 Extension.
- Installation of erosion and sediment control structures over the Stage 2 Site.
- As for the development phase, an ESCP would be prepared for the Stage 2 Extension. The ESCP would delineate the limits to disturbance as noted above and provide the locations, designs and maintenance requirements for structures aimed diverting, capturing and storing water on the Stage 2 Site.
- Management of water captured on the Stage 2 Site in accordance with the recommendations of Groundwork Plus (2014) (refer to Section 4.5.4), most notably the controlled discharge of water, once water quality criteria are confirmed, to maintain environmental flows.

4.8.4.3.2 Dewatering

Potential Impacts

Dewatering of the extraction area would reduce the SWL of the groundwater table below the Stage 2 Site (refer to Section 4.12.5). However, Ground Doctor (2014) has assessed the likely post-extraction hydrogeological conditions and concludes that the SWL would remain more elevated than the surrounding water courses (see Section 4.6.5.1 and **Figure 4.35**), with a hydraulic gradient still maintained towards these water courses (including Yorkeys Creek and the Coxs River). The potential for groundwater to continue to discharge into the surrounding areas due to this gradient would help to maintain pre-development conditions and significant changes to the current site water balance are not expected. On the basis of the isolated nature of groundwater reduction, Cardno (2014) consider the likely impact on base flows to these watercourses to be nil to negligible for Coxs River.

A small reduction in the available groundwater to the base flows of the gullies within the predicted cone of depression, i.e. 225m from the perimeter of the extraction area, may occur.

Avoidance, Mitigation and Management Measures

The dewatering of the extraction area and subsequent reduction in the groundwater SWL cannot be avoided, however, impacts to base flows would be mitigated by ensuring that treated water captured in the Stage 2 Site sediment basins and storage dams is regularly discharged to Yorkeys Creek and the Coxs River in accordance with the recommendations of Groundwork Plus (2014) (refer to Section 4.5.4).

The Applicant would also implement a monitoring program to estimate the actual volume of groundwater flowing into the extraction area. Should this significantly exceed the predictions of Ground Doctor (2014) (refer to Section 4.12.5), a more detailed, quantitative investigation would be undertaken to review potential impacts on surrounding surface and groundwater dependent ecosystems.

4.8.4.3.3 Water Retention and Use

Potential Impacts

Increased retention and operational use of water, as a result of the larger disturbance footprint, could result in the following impacts.

- Reduced runoff and environmental water available to downstream aquatic ecosystems.
- Changes to flows regime within in the Coxs River South catchment as a result of increasing the volume of Sediment Basin SB3b (although as an operational requirement, this water would be regularly discharged following treatment to restore the required water settlement capacity);
- Reduced groundwater quality through movement of contaminated water from on-site into the underlying aquifer;
- Elevated erosion at pipe outlet points associated with increased operational use and transfers.

Avoidance, Mitigation and Management Measures

Following from the recommendations of Cardno (2014), the following impact avoidance, mitigation and management measures would be implemented.

- Potential sources of contamination to water storages would be segregated from the catchments to these.
- Appropriate wet weather storage would be maintained;
- Appropriate off-take depth at water pumping sites would be maintained and scour protection at pipe outlet points would be installed.

4.8.4.3.4 Water Discharge

Potential Impacts

In accordance with the recommendations of Groundwork Plus (2014), water would be regularly discharged from the Stage 2 Site (refer to Section 4.5.4). Potential impacts of water discharge could include:

- release of sediment-laden water into the aquatic environment leading to detrimental effects on aquatic flora and fauna;
- release of water containing other aquatic contaminants into the aquatic environment leading to detrimental effects on aquatic flora and fauna; and
- increased erosion around the discharged points, resulting in detrimental effects on aquatic flora and fauna.

Avoidance, Mitigation and Management Measures

Following from the recommendations of Cardno (2014), the following impact avoidance, mitigation and measures would be implemented.

- The sediment basins and storage dams of the Stage 2 Site would be constructed and maintained and monitored in accordance with the recommendations of Groundwork Plus (2014) (refer to Section 4.5.4.2) and EPL 12323, to ensure discharges are within the specified limits.
- The sediment basins and storage dams would be managed and appropriate wet weather storage would be maintained to ensure sufficient freeboard is available to accommodate normal wet weather events and minimise uncontrolled discharge to the environment.
- The discharge points would be constructed to prevent excess erosion and in particular, to prevent potential overflow and undermining of water control structures that could lead to catastrophic failure of retention basins.

4.8.4.3.5 Groundwater Quality

Contamination of local groundwater by water containing hydrocarbons or elevated nitrate concentration, which could have a deleterious effect on subsurface organisms if present, is highly unlikely due to the hydraulic gradient which would be developed during and following

extraction (see Section 4.6.5.1). This would provide for the in-flow (seepage) of groundwater into the extraction area, not the reverse (Ground Doctor, 2014). Furthermore, the characteristic low porosity of the rhyolite (0.7%), and its resistance to fracturing, reduced permeability and the potential for movement of water through the strata.

The reduced potential for impact notwithstanding, the Applicant has committed to undertaking monitoring of groundwater with water quality analysis to be undertaken periodically to confirm no contamination of local groundwater.

4.8.4.4 Quarry Decommissioning and Rehabilitation

Potential Impacts

As a consequence of vegetation removal, landform re-profiling, soil respreading, weed management and revegetation, potential impacts could include:

- erosion of the final landform resulting in discharge of water containing sediments and contaminants such as fertilisers and herbicides to the receiving waters.

Cardno (2014) also note that the construction of new landscape features, such as riparian vegetation and the geomorphology of drainage features and dams during rehabilitation could impact on aquatic ecosystems if they are inappropriate for the local landform. This could lead to slumping and/or increased erosion/mass wasting and associated impacts to downstream aquatic ecosystems.

Avoidance, Mitigation and Management Measures

Following from the recommendations of Cardno (2014), the following impact avoidance, mitigation and measures would be implemented.

- Minimisation of exposed (unvegetated) areas of the final landform.
- Implementation of an ESCP incorporating the decommissioning and rehabilitation phase.
- Stabilisation of all earthworks, watercourses and disturbed areas in the short to medium term.
- Design and construction of a final landform that is stable and safe with minimal erosion.

4.8.5 Assessment of Impacts

4.8.5.1 Aquatic Habitat and Conditions

4.8.5.1.1 Land Preparation

Ultimately, the impact of land preparation activities on the aquatic environment of the receiving waters would be a function of:

- the proximity of these works to the Coxs River and associated watercourses; and
- the effectiveness of the proposed management measures.

Cardno (2014) has assessed that the activities associated with land preparation of the Stage 2 Extension are unlikely to cause significant impacts on existing aquatic habitats, aquatic flora or aquatic fauna, provided that appropriate measures to avoid, minimise and manage impacts are implemented. The most notable measures being the implementation of an ESCP and minimisation of uncontrolled discharges from sediment basins and storage dams through adoption of the water transfer and management system recommended by Groundwork Plus (2014) (refer to Section 4.5.4).

Given the various sediment basins of the Stage 2 Site would be managed to retain sufficient water settlement and sediment storage capacity for a 95th percentile 5-day rainfall event (see Section 4.5.4.1) the potential for uncontrolled discharge of water from these structures would be minimised (see Section 4.5.5). Conditions under which an uncontrolled discharge may occur would almost certainly coincide with periods of elevated flows and level within the Coxs River and Yorkeys Creek when background suspended sediment levels would be naturally elevated. Cardno (2014) notes that the aquatic flora and fauna that occur in the watercourses within and adjacent to the Stage 2 Site would be fairly tolerant of such short term increases in sediment load as occur during periodic rainfall events.

4.8.5.1.2 Quarry Operation

The loss of aquatic habitat from the upper catchments of those watercourses within the impact footprint of the Stage 2 extraction area and overburden emplacement is considered to be a minor and localised impact (Cardno, 2014). Cardno (2014) also reports that through appropriate water management associated with erosion and sediment control, dewatering, retention, operational use and discharge, the potential impacts on receiving aquatic ecosystems identified would be largely mitigated.

It is therefore considered that the ongoing extraction and overburden emplacement activities would not cause significant impacts on aquatic habitats, aquatic flora or aquatic fauna, provided that appropriate measures to avoid, minimise and manage impacts are implemented.

4.8.5.1.3 Quarry Decommissioning and Rehabilitation

Cardno (2014) concludes that the activities undertaken during the decommissioning and rehabilitation phase would be unlikely to cause significant impacts on aquatic habitats, aquatic flora or aquatic fauna, provided that appropriate measures to avoid, minimise and manage impacts are implemented.

4.8.5.1.4 Conclusion

It is worthy of note that the Proposal represents an extension of operations that have been undertaken within the local setting since 2005. As is documented in Cardno (2014), the results of monitoring aimed at identifying any detrimental impacts on the health of the local aquatic environment has comprehensively demonstrated that quarry operations undertaken to date have been undertaken within the local setting without adverse impacts. It is acknowledged that the impact footprint of the quarry would be increased, however, as the proposed activities would remain unchanged with appropriate water management strategies in place, there is no reason to believe that the impacts of the extended operations would be significantly different to those of the current operations.

4.8.5.2 Groundwater Dependent Ecosystems

The occurrence of surface GDEs on and surrounding the Stage 2 Site is limited to the River Oak riparian forest vegetation community which occurs within the riparian zone of the Coxs River (Niche, 2014a). The impact on the condition of this vegetation of a minor reduction in groundwater storage of the rhyolite hosted aquifer, and/or a very minor reduction in the availability of groundwater to contribute to flows in the upper slopes of the gullies discharging to the Coxs River (within the cone of depression) is considered to be insignificant when compared to the impact of seasonal flows and storm surges during high rainfall events (Niche, 2014a).

The potential for impact on hyporheic fauna is nil to negligible as Ground Doctor (2014) does not predict any impact on the hyporheic zone, i.e. stream bed, of the Coxs River.

The potential for stygofauna to be present within the rhyolite hosted aquifer is considered to be very low (see Section 4.8.3.2.3). However, even if present, the extent of the groundwater drawdown is anticipated to be restricted to a distance of approximately 225m from all sides of the extraction area (Ground Doctor 2014). Hence, the spatial extent of impact would be highly restricted. Furthermore, dewatering of the extraction area and cone of depression would only be accelerating the natural discharge of groundwater which naturally occurs to surrounding gullies and the Coxs River.

4.8.5.3 Threatened Species and Key Threatening Processes

4.8.5.3.1 Macquarie Perch

Cardno (2014) completed an assessment of the significance of the Proposal on the only threatened species considered as possibly occurring along the stretch of the Coxs River potentially impacted. Cardno (2014) concluded that it would be unlikely that the Proposal would have a significant effect on known Macquarie Perch populations within the Coxs River downstream of the Stage 2 Site. There is, however, a potential that the cumulative impacts of extractive industries within the upper Coxs River could have an impact on this species with respect to water quality and hydrological pressures, although the Proposal is considered to be a small component of the overall cumulative potential impact.

4.8.5.3.2 Key Threatening Processes

Each of the KTPs identified as relevant to the Proposal have been reviewed by Cardno (2014) in relation to how the Proposal may influence these.

- Novel biota and their impact on biodiversity.

  Considering that no additional water transfers are proposed, aquatic pest species found in the catchment are unlikely to be introduced into new habitats and amplification of this KTP is therefore considered highly unlikely.

- Degradation of native riparian vegetation along New South Wales watercourses.

  There is a potential that native riparian vegetation could be degraded if altered groundwater dynamics associated with dewatering of the extraction area restrict water to these communities. However, Cardno (2014) consider the likelihood of

this being significant and widespread is low, as groundwater impacts are expected to be restricted spatially (to the immediate surrounds of the extraction area) and temporally (until a new groundwater – surface water interaction equilibrium is established – see **Figure 4.35**).

Where extraction and overburden placement will take place, there would be an unavoidable loss of approximately 800m of aquatic habitat, flora and fauna from the upper reaches of the North and South Catchment tributaries. Cardno (2014) consider this to be minimal on a regional scale.

- In-stream structures and other mechanisms that alter natural flows / alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.

  There is likely to be some alteration of the natural flow of water in the Coxs River North and South Catchments associated with the extension of the extraction area and overburden emplacement. Additionally, some in-stream structures such as sediment basins may affect the natural flow of water. In the case of sediment basins, these structures are considered a necessary measure to prevent sediment impacts downstream.

  Notably, no work is proposed to occur on the major waterways around the Stage 2 Site (Yorkeys Creek or the Coxs River) and therefore there is limited scope for the Proposal to amplify this KTP.

4.8.6 Monitoring

The Applicant has committed to continuing to monitor from the sites identified on **Figure 4.41** in accordance with the AUSRIVAS methodology. Monitoring related to water quality is described and discussed in Section 4.5.7.

4.9 NOISE

4.9.1 Introduction

The DGRs issued for the Proposal identified "*Noise*" as a key issue requiring that the "*EIS include a quantitative assessment of the potential:*

- *construction, operational and transport noise impacts;*
- *reasonable and feasible mitigation measures, including evidence that there are no such measures available other than those proposed; and*
- *monitoring and management measures, in particular real-time, attended noise monitoring.*

Additional matters for consideration in preparing the EIS were also provided in the correspondence attached to the DGRs from the EPA which related to both noise and vibration impacts and request that: *the Proponent must carry out a detailed Noise Impact Assessment and Modelling that addresses:*

- *off-site road noise impacts focusing on current versus proposed hours of operation — consistent with the NSW Road Noise Policy (DECCW, 2011);*
- *construction noise impacts — consistent with the NSW Interim Construction Noise Guideline (DECC, 2009);*
- *operational noise impacts — consistent with the NSW Industrial Noise Policy (EPA, 2000) and the Assessing Vibration: a technical guidelines (DEC, 2006); and*
- *mitigation and management strategies.*

Also appended to the DGRs is correspondence from DTIRIS and Lithgow City Council requesting detailed information and assessment related to noise and vibration impacts including mitigation measures and consideration of noise and vibration impacts on the Glenroy Bridge and camping (grassed) area.

Based on the risk analysis undertaken for the Proposal (Section 3.3.1 and **Table 3.9**), the potential impacts relating to noise and vibration and their risk rankings (in parenthesis) after the adoption of pre-existing or standard mitigation measures are as follows.

- Increased noise levels from fixed and/or mobile plant, equipment and trucks on site resulting in:
  - annoyance and/or disturbance to local residents, businesses and other landowners (medium risk);
  - adverse effects on physical or mental health (medium risk);
  - increased community and regulatory scrutiny (medium risk);
  - relocation of and/or reduction of local native fauna species due to noise disturbance (medium risk);
  - reduced agricultural productivity of livestock (low risk).
- Increased noise levels from trucks transporting quarry products resulting in:
  - annoyance and/or disturbance to local residents, businesses and other landowners (medium risk);
  - adverse effects on physical or mental health (medium risk); or
  - increased community and regulatory scrutiny (medium risk).
- Noise from blasting resulting in:
  - adverse effects on physical or mental health (medium risk); or
  - increased community and regulatory scrutiny (low risk).

- Vibration from blasting resulting in:
  - reduced local amenity (medium risk); or
  - structure damage to buildings (low risk); or
  - increased community and regulatory scrutiny (medium risk).

A review of the attributed risk levels, following the adoption of the recommended operational safeguards and controls, is provided in Section 6.2.1 and **Table 6.1**.

The noise impact assessment for the Proposal was undertaken by Mr Felipe Torres and Mr Daniele Albanese of Benbow Environmental. The assessment is presented as Part 6 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Benbow (2014a)". This subsection of the EIS provides a summary of the noise impact assessment, concentrating on those matters raised in the DGRs and related requirements provided by various government agencies. A consolidated list of the identified requirements and where each is addressed is presented in **Appendix 3**.

4.9.2 Existing Noise Climate

4.9.2.1 Introduction

The existing meteorological and acoustic environment surrounding the Stage 2 Site has been reviewed in order to determine the atmospheric conditions under which noise modelling is required, as well as to establish noise criteria at representative receivers surrounding the Austen Quarry and adjacent to the transport route. The following subsections provide a summary of the existing noise sources, meteorological conditions and background noise levels against which noise criteria are set.

4.9.2.2 Existing Noise Sources

Existing noise levels in the vicinity of the Stage 2 Site are influenced by a range of sources including traffic on Jenolan Caves Road and local roads, agricultural equipment, flow of the Coxs River, stock, wind in trees, wildlife, as well as noise associated with existing Austen Quarry operations.

4.9.2.3 Meteorological Conditions

Wind and temperature inversions may affect the transmission of noise from source to surrounding receivers and, as noted in Section 4.1.2.5, Benbow (2014a) has generated a site-representative meteorological data file using data collected from the on-site meteorological station and The Air Pollution Model (TAPM). **Figure 4.1** presents the seasonal wind rose plots generated by this meteorological data file.

The analysis of wind vector components up to 3m/s at angles of ±45° relative to each primary direction established that winds at speeds of 0.5 to 3.0m/s were recorded from the northwest for more than 30% of the time during Autumn and Winter. In accordance with the INP, therefore, noise modelling needs to consider this directional wind condition as a noise enhancing condition to receivers to the southwest of the Site.

Temperature inversion conditions are generally associated with F-class stability conditions, represented by still/light winds and clear skies during the night time or early morning period (stable atmospheric conditions). Benbow (2014a) analysed the 2012-2013 weather data of the on-site meteorological station and identified that during winter approximately 60% of the nights presented temperature inversion conditions. As the INP specifies that a temperature inversion is a feature of the local atmospheric setting when occurring more on than 30% of winter nights, these noise enhancing conditions must be included in the assessment of noise impact generated by the Proposal.

4.9.2.4 Background Noise Levels

In order to determine ambient (background) noise levels, three noise loggers were placed at representative locations surrounding the Austen Quarry and transport route. The locations of these noise monitoring locations (A, B and C) are presented on **Figure 4.44**. A description of each location is provided in **Table 4.30**.

Table 4.30
Noise Monitoring Locations

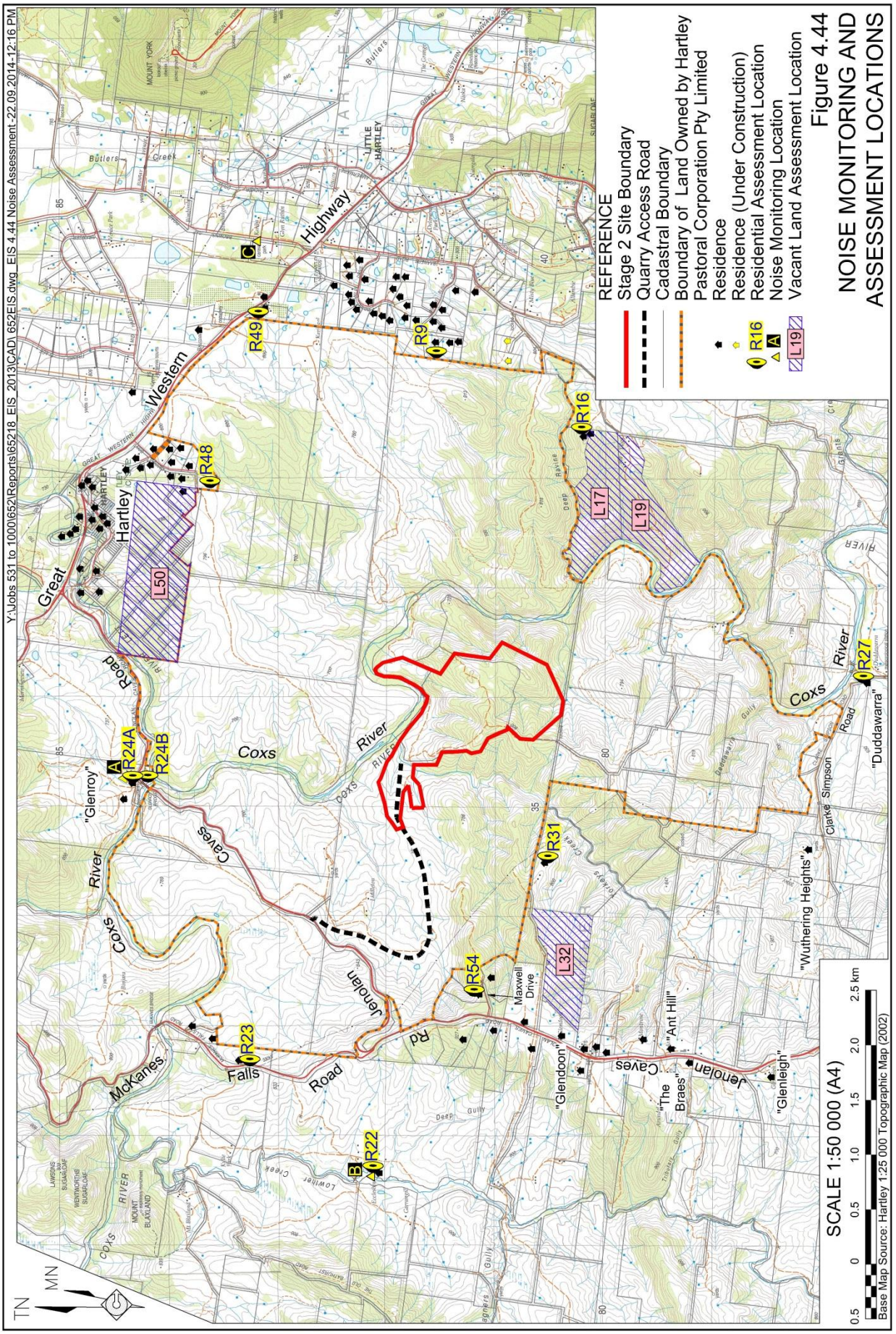
Location[1]	Property Reference (Lot, DP)	Address	Distance to the Quarry
A	10, 830372	200 Jenolan Caves Road	2 600m
B	100, 1058004	770 Jenolan Caves Road	3 000m
C	41, 865372	66 Dicker Drive, Little Hartley	5 000m
Note 1: see **Figure 4.44**			

Unattended long-term noise monitoring was undertaken from 4 to 13 June 2013 at all three locations and attended noise monitoring was conducted at the commencement and conclusion of the monitoring period at each. The measured noise levels have been considered as representative of the existing ambient noise environment of the area.

Noise levels were continuously monitored at 15-minute intervals and the data analysed to determine the L_{90} noise level on each day of monitoring, i.e. the noise level which is exceeded 90% of the time. The L_{90} Rating Background Noise Level (RBL) was then calculated as the median L_{90} noise level over the duration of the noise survey. **Table 4.31** provides the calculated RBLs for the three noise logger locations.

Table 4.31
Measured Ambient Noise Levels

Location	Measured Noise Level (dB)										
	Average L_1			ABL (Median L_{90})			Average L_{eq}			Road Traffic Noise	
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day ($L_{Aeq(15\ hour)}$)	Night ($L_{Aeq(9\ hour)}$)
A	74	69	57	39	39	38	63	58	56	63	53
B	72	66	53	27	22	21	59	54	51	59	50
C	52	50	47	35	34	30	47	46	41	-	-
Source: Modified after Benbow (2014a) – Tables 3-2 to 3-4											


Y:\Jobs 531 to 1000\652\Reports\65218_EIS_2013\CAD\652EIS.dwg_EIS 4.44 Noise Assessment-22.09.2014-12:16 PM
REFERENCE
Stage 2 Site Boundary
Quarry Access Road
Cadastral Boundary
Boundary of Land Owned by Hartley Pastoral Corporation Pty Limited
Residence
Residence (Under Construction)
Residential Assessment Location
Noise Monitoring Location
Vacant Land Assessment Location
Figure 4.44
NOISE MONITORING AND ASSESSMENT LOCATIONS
SCALE 1:50 000 (A4)
0.5 0 0.5 1.0 1.5 2.0 2.5 km
Base Map Source: Hartley 1:25 000 Topographic Map (2002)
TN MN
R9
R16
R22
R23
R24A
R24B
R27
R31
R48
R49
R54
L17
L19
L32
L50
Great Western Highway
Hartley
Coxs River
Jenolan Caves Road
McKanes Falls Road
Maxwell Drive
"Glenroy"
"Glendoon"
"Ant Hill"
"The Braes"
"Glenleigh"
"Wuthering Heights"
"Duddawarra"
Clarke Simpson
Butlers Creek
Lowther Creek

The following provides a summary of the dominant noise sources recorded at each monitoring location.

- At 200 Jenolan Caves Road (Location A), the acoustic environment was dominated by truck pass-bys, occasional loud bird noise and constant noise generated by the flow of the Coxs River.
- At 770 Jenolan Caves Road (Location B), the acoustic environment was dominated by traffic on Jenolan Caves Road, insect and bird noise.
- At 66 Dicker Drive (Location C), the acoustic environment was dominated by traffic hum and occasional louder truck pass-bys from the Great Western Highway, traffic on local roads, birds with Austen Quarry drilling faintly audible.

Benbow (2014a) notes that the constant noise source from the flowing Coxs River is unrepresentative of the RBL of the remainder of the local setting hence this location has not been considered for the purpose of establishing the noise criteria. On the basis of the results collected at Locations B and C, Location B presents the lowest background levels (<30dB(A)) and Benbow (2014a) has therefore been considered these noise levels in derivation of the project specific noise levels (see Section 4.9.3).

4.9.3 Environmental Noise and Vibration Criteria

4.9.3.1 Introduction

The following subsections summarise the noise and blasting criteria that were used to assess the noise and vibration impacts of the Proposal on the surrounding environment.

For the purposes of defining noise criteria relevant to the on-site operations of the Proposal, the following times are relevant to the daytime, evening, night-time periods (Monday to Saturday).

- Daytime – 7:00am to 6:00pm
- Evening – 6:00pm to 10:00pm
- Night-time – 10:00pm to 7:00am

For Sundays and public holidays, the night-time period extends from 10.00pm to 8.00am.

For the purposes of considering road traffic noise, only two periods are considered.

- Daytime – 7:00am to 10:00pm (15 hours).
- Night-time – 10:00pm to7:00am (9 hours).

4.9.3.2 Operational Noise Assessment Criteria

The Environment Protection Authority released the NSW *Industrial Noise Policy* (INP) in January 2000 (EPA, 2000). The INP provides a framework and process for deriving operational noise criteria for development consents under the EP&A Act and setting operational

noise limits in environment protection licences under the POEO Act. The Proposal is a scheduled activity under Schedule 1 of this latter Act. The INP specifies two noise criteria, namely:

- an intrusiveness criterion which requires that the equivalent continuous noise level ($L_{Aeq,15min}$) from a specific industrial source at a privately-owned receptor should not exceed the background noise level by more than 5 decibels; and
- an amenity criterion which aims to maintain noise amenity throughout a community over the whole daytime, evening or night-time periods and considers cumulative noise from all industrial sources.

A fundamental difference between the intrusiveness and the amenity criteria is the time period over which the noise is measured and this is further discussed below.

Intrusiveness Criteria

The intrusiveness criteria require that $L_{Aeq(15min)}$ noise levels from a newly introduced source during the day, evening and night do not exceed the existing rating background level (RBL) by more than 5dB. This is expressed as $L_{Aeq(15min)} \leq RBL + 5 - K$, where $L_{Aeq(15min)}$ is the L_{eq} noise level from the source measured over a 15 minute period and K is a series of adjustments for various noise characteristics. Benbow (2014a) considers the inclusion of a shoulder period between 5:00am and 7:00am when background noise levels may steadily rise from night time noise levels. However, as Benbow (2014a) has taken a conservative approach to the establishment of an RBL (<30dB(A)[6]), a separate shoulder period is not required. A single intrusive criteria of 35dB(A) has been established for the Proposal at all surrounding residences.

Amenity Criteria

The amenity assessment is based on noise criteria specific to the land use. As there are no existing industries within the local setting, the base amenity industrial criterion does not apply. For sensitive receptors located in and around the Stage 2 Site, the rural-residential category is suitable. The amenity criteria for active recreation areas could also be considered given the proximity of the Coxs River. **Table 4.32** presents the base amenity criteria for the Stage 2 Site.

Table 4.32
Amenity Noise Criteria

Receptor	Indicative Area	Time Period	Recommended Noise Level L_{eq} period (dB(A))	
			Acceptable	Maximum
Residential	Rural	Day	50	55
		Evening	45	50
		Night	40	45
Active Recreation Area	All	When in use	55	60
Source: Benbow (2014a) - Table 4-2.				

[6] The INP states that when the readings are below 30dB, a noise level equal to 30dB shall be considered.

Low Frequency Noise Criteria

Low frequency noise is typically defined as noise with frequencies below 100Hz, and includes infrasound, i.e. frequencies <20Hz. The INP states that where there is a difference of 15 decibels or more between C and A weighted noise levels[7], than a correction factor of 5dB is applicable.

Sleep Disturbance Criteria

The occurrence of maximum noise levels over a very short time period (referenced and measured as the $L_{A(1min)}$ noise level) have potential to cause sleep disturbance to nearby residents. The World Health Organisation recommends individual noise events to be contained under 45dB(A) L_{Amax} (internal) in order to minimise sleep disturbance[8].

Based on the above, an appropriate sleep disturbance criteria of 45dB(A) L_{Amax} (internal) was considered for all residential premises surrounding the Stage 2 Site. Benbow (2014a) notes that this approach of setting an internal limit, as opposed to an external limit, has been applied to similar noise assessments that consider night-time site operations and vehicle movements and has been accepted as a suitable noise management approach that is fair and reasonable.

On the basis that a 10dB(A) reduction in sound pressure level is provided by the façade and ceiling of the house (based on windows being partially open), the L_{Amax} (sleep disturbance) criteria measured at the house façade would be 55dB(A).

Project Specific Noise Criteria

Table 4.33 provides a summary of the Project Specific Noise Criteria to be applied to on-site (operational) noise of the Proposal.

Table 4.33
Project Specific Noise Criteria – On-Site Operations

Receiver Location	Period	Intrusive Criterion $L_{Aeq(15\ minute)}$	Amenity Criterion $L_{Aeq(15\ minute)}$	Project Specific Noise Limit $L_{Aeq(15\ minute)}$	Site Sleep Disturbance L_{Amax}
All Residential Receivers	Day	35	50	35	-
	Evening	35	45	35	-
	Night (5:00am – 7:00am)	35	40	35	55
Source: Modified after Benbow (2014a) – Table 4-7.					

[7] The A-Weighted noise level effectively cuts off the lower and higher frequencies that the average person cannot hear, i.e. it provides for the noise actually heard by the human ear. The C-Weighted noise level includes the higher and particularly lower frequency noise and is used to assess potential damage that may be caused by the imperceptible component of loud noise.

[8] Section 5.4 of the NSW Road Noise Policy (DECCW, 2011) provides further guidance on the effects of disruption of a person's normal sleep patterns due to noise, reporting that:

- maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep; and
- one or two noise events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect health and well being significantly.

While the INP does not declare criteria for the assessment of noise emissions impacting on vacant land, historically the DP&E and EPA have required that the $L_{Aeq(15min)}$ noise level should not exceed the Project Specific Noise Criteria on more than 25% of the property.

4.9.3.3 Off-Site Traffic Noise Criteria

Total Traffic Noise Criteria

Criteria for assessment of noise from traffic on public roads are set out in the NSW Road Noise Policy (RNP) (DECCW, 2011). Under this policy, the Jenolan Caves Road would be considered as an arterial road type and therefore assessed against the criteria for the "arterial or sub-arterial road" category (see **Table 4.34**).

Table 4.34
Criteria for Traffic Noise – Total

Road Category	Type of Land Use	Noise Level Criterion	
		Day (7:00am to 10:00pm)	Night (10:00pm to 7:00am)
Arterial	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use development	$L_{Aeq,15hr}$ 60dB(A)	$L_{Aeq,9hr}$ 55dB(A)
Source: Modified after Benbow (2014a) - Table 4-5.			

Relative Increase Criteria

In addition to the total traffic noise level criteria, the RNP also outlines relative increase criteria for residential land uses (see **Table 4.35**).

Table 4.35
Criteria for Traffic Noise – Relative Increase

Road Category	Type of Land Use	Noise Level Criterion	
		Day (07.00am to 10.00pm)	Night (10.00pm to 07.00am)
Arterial	New road corridor/redevelopment of existing road/land use development with potential to generate additional traffic on existing road	Existing traffic $L_{Aeq,15hr}$ + 12dB(A) (external)	Existing traffic $L_{Aeq,9hr}$ + 12dB(A) (external)
Source: Modified after Benbow (2014a) - Table 4-6.			

Sleep Disturbance

The sleep disturbance criteria for off-site traffic noise is the same as that for on-site operational noise.

Project Specific Noise Criteria

Based on the noise levels measured at Locations A, B and C, and distance between the façade of each residence and the road surface, Benbow (2014a) used SoundPLAN v7.2 to determine the existing road traffic noise levels. Benbow (2104a) has identified the residences located along Jenolan Caves Road between the Site Entrance and the Great Western Highway as the receptors most affected by traffic noise.

Table 4.36 provides the existing road traffic noise as calculated by Benbow (2014a) as well as a summary of the Project Specific Noise Criteria to be applied to off-site (traffic) noise of the Proposal.

Table 4.36
Project Specific Noise Criteria – Off-Site Road Noise

Reference	Existing Road Traffic Noise Levels[1]		Total Traffic Noise Criteria		Relative Increase Criteria		Sleep Disturbance Criteria L_{Amax} (Outdoor)
	Day $L_{Aeq\ (15\ hour)}$	Night $L_{Aeq\ (9\ hour)}$	Day $L_{Aeq\ (15\ hour)}$	Night $L_{Aeq\ (9\ hour)}$	Day $L_{Aeq\ (15\ hour)}$	Night $L_{Aeq\ (9\ hour)}$	
R22	46.4	36.4	60	55	58	48	55dB(A)
R23	44.8	34.8	60	55	57	47	
R24A	67.8	57.8	60	55	80	70	
R24B (grassed area)	67.8	57.8	60	55	80	70	
R24B (cottages)	63.7	53.7			76	66	
R48	52.4	42.4	60	55	64	54	
Note 1: Calculated based on measured noise levels at Locations A, B and C – see **Figure 4.43**							
Source: Modified after Benbow (2014a) - Table 4-8.							

4.9.3.4 Blasting Criteria

The EPA has adopted recommended airblast and ground vibration levels published by the Australian and New Zealand Environment and Conservation Council (ANZECC). These recommended levels are based on prevention of human discomfort and have been adopted as the assessment criteria for the blasting assessment for residential receptors.

- The maximum vibration level for airblast should not exceed 115dB linear peak on more than 5% of the total number of blasts over 12 months. The maximum level should not exceed 120dB linear peak at any time.
- Peak particle velocity (PPV) from ground vibration should be less than 5mm/s for more than 5% of the total number of blasts over 12 months. The maximum level should not exceed 10mm/s at any time.

Building damage assessment criteria are nominated in AS 2187.2-1993 *Explosives – Storage, Transport and Use Part 2: Use of Explosives*, however, as the ANZECC annoyance criteria are more stringent, these are taken as the governing criteria for the Proposal.

4.9.4 Design and Operational Safeguards

The Proposal has been designed with an objective to minimise the noise generated by extraction, processing and transport activities. The design features and operational noise controls of the Project to meet this objective are as follows.

Design Features

- No additional processing equipment is proposed with all fixed plant to remain in current locations, i.e. noise from processing operations would remain the same as that currently generated.

- The continued operation of the primary conveyor between the primary crushing station and secondary processing area reduces noise emissions significantly by avoiding the requirement for truck movements between the extraction and processing areas.
- By sequencing the proposed Stage 2 extraction area to reduce the visual exposure of the extraction operations, noise attenuation is also provided.

Operational Safeguards

- All hours of operation presented in Section 2.11.1 would be strictly adhered to.
- The maximum number of truck movements per hour and per day nominated in Section 2.8.3 would be adhered to.
- All drivers would be required to sign the chain of responsibility documentation requiring a high standard of driver performance, avoidance of using exhaust brakes in built-up areas and travel at the required speeds.
- The internal road network would be graded as required to limit body noise from empty trucks.
- All equipment on site would be regularly serviced to ensure sound power levels of each item remains at or below that nominated for noise modelling purposes (see *Table 5-1* of Benbow, 2014a).
- Noise monitoring would be undertaken at nearby residences and the results and performance of the site operations discussed with local residents and landholders. Monitoring is further discussed in Section 4.9.7.
- Maintenance work on all plant and equipment would be confined to standard daytime operational hours where practicable. Any inaudible maintenance could be undertaken beyond these core hours.

4.9.5 Assessment Methodology

4.9.5.1 Operational Noise

Assessment of operational noise was undertaken by Benbow (2014a) using the Concawe algorithm within SoundPLAN v7.2. The model allows for the prediction of noise, at specified receptors, by calculating the contribution of each noise source. The Sound Power Level of each noise source on the Stage 2 Site was measured by Benbow (2014a).

Noise modelling was carried out for three operating scenarios, representative of Stages A, C and E of the extraction sequence (see **Figure 2.6**). **Figures 4.45** to **4.48** illustrate the locations of the noise sources for each scenario, each of which are modelled as occurring concurrently for 100% of a 15 minute averaging period. Based on the local meteorological conditions discussed in Section 4.3.2.3, each scenario was modelled under the following conditions.

- Condition A – neutral (calm) conditions.
- Condition B – 3°C/100m temperature inversion with 2m/s wind from source to receiver.
- Condition C – 3m/s wind blowing from northwest.

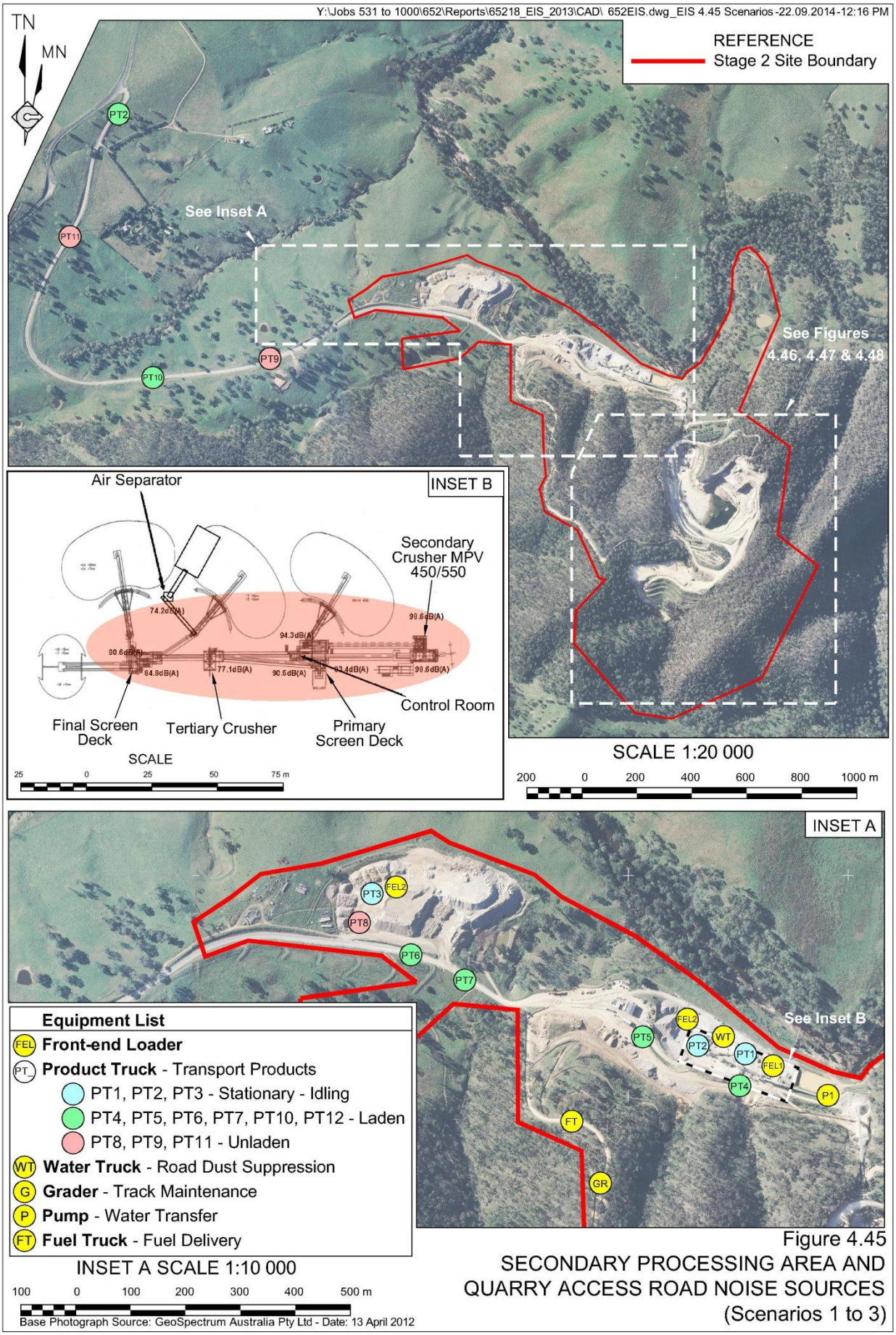


Figure 4.45
SECONDARY PROCESSING AREA AND QUARRY ACCESS ROAD NOISE SOURCES (Scenarios 1 to 3)

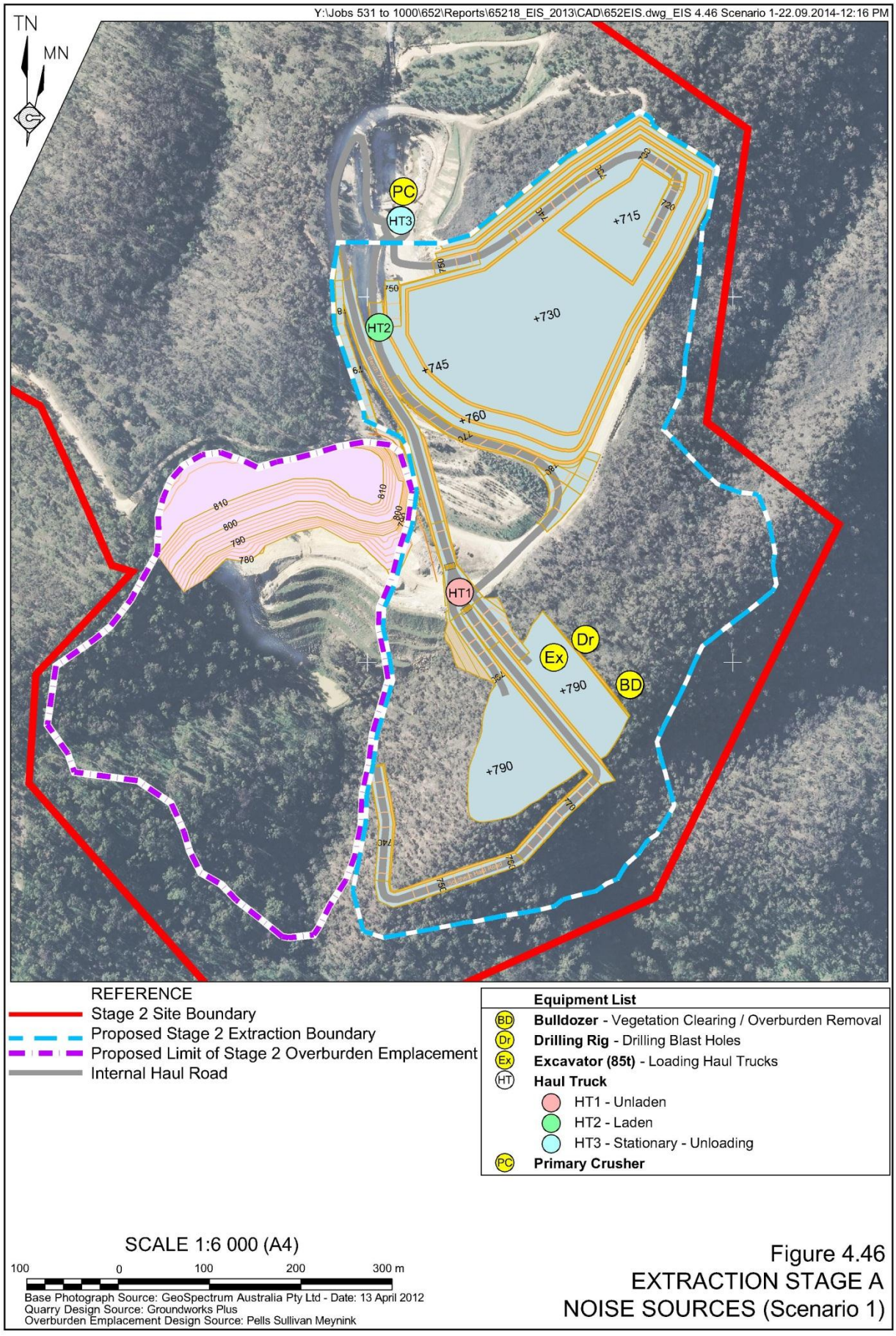


Figure 4.46
EXTRACTION STAGE A
NOISE SOURCES (Scenario 1)

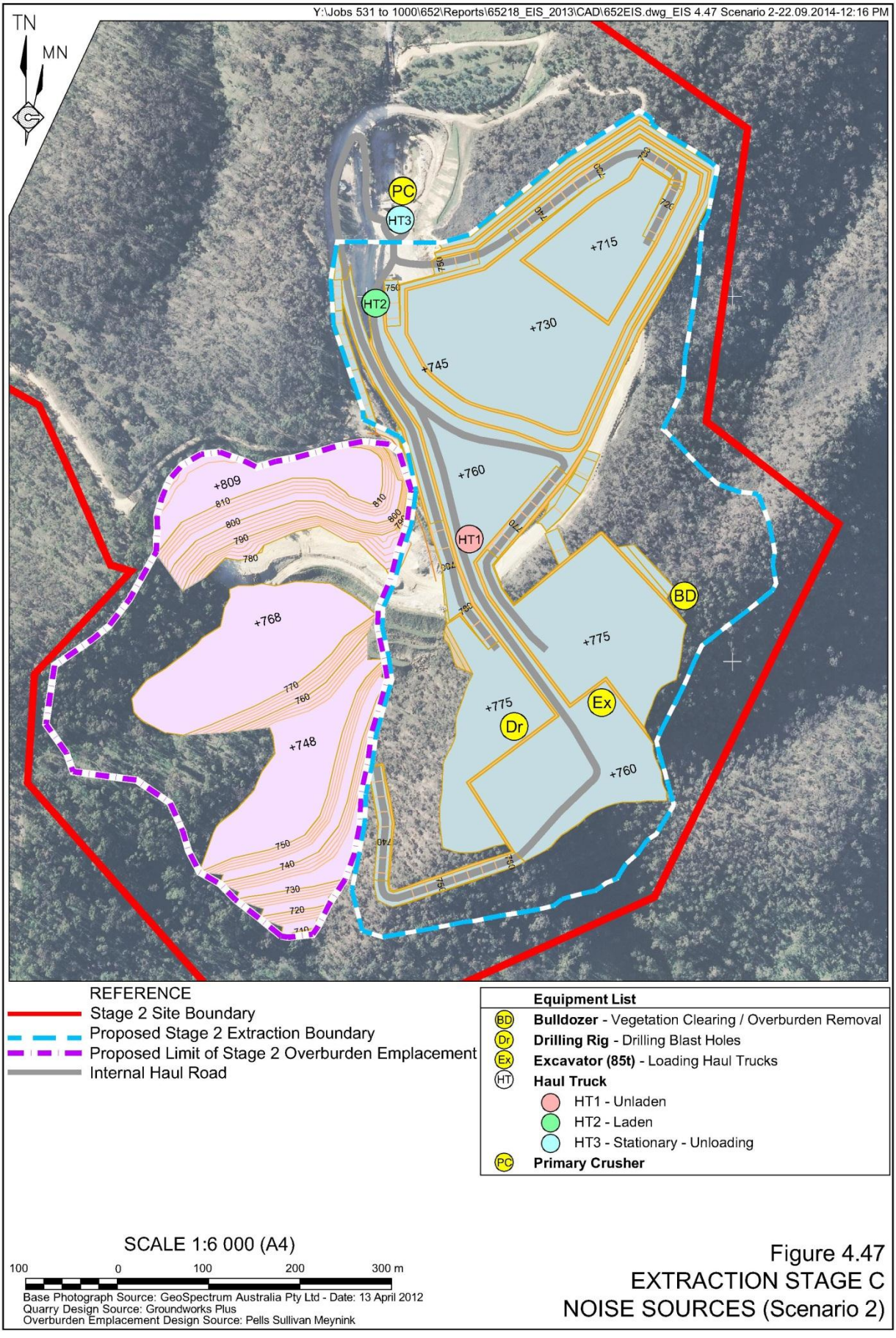


Figure 4.47
EXTRACTION STAGE C
NOISE SOURCES (Scenario 2)

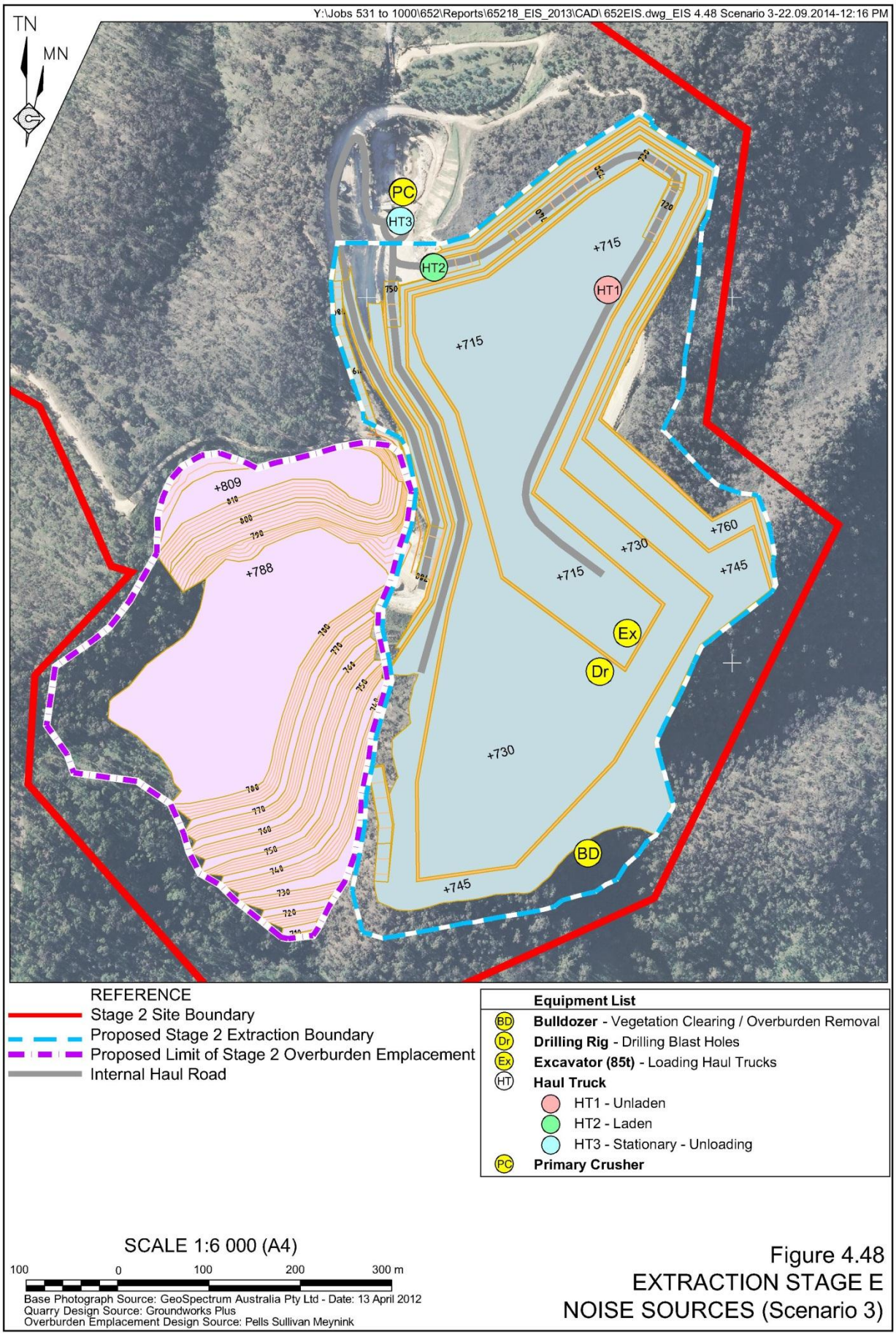


Figure 4.48
EXTRACTION STAGE E
NOISE SOURCES (Scenario 3)

Considering the nominated noise sources, meteorological conditions and local topography, the $L_{Aeq(15\ minute)}$ noise level[9] received at 11 representative residential receivers closest to the Stage 2 Site was predicted.

4.9.5.2 Operational Noise on Vacant Lands

For the purpose of assessing impacts on vacant land surrounding the Stage 2 Site, the most proximal undeveloped blocks to the north, southeast and southwest were identified and included in the noise model prepared by Benbow (2014a) as receptors. **Table 4.37** and **Figure 4.44** identify the location of the vacant land, with noise levels predicted for each of the three operating scenarios described in Section 4.9.5.1.

Table 4.37
Vacant Lands

Reference[1]	Property	Approximate Distance
L17 and L19	Lot 11 and Lot 4 DP1113701	1 000m
L32	Lot 2 DP870895	1 650m
L50 (Subdivision)	Various lot subdivisions	2 300m
Note 1: see **Figure 4.44**		

4.9.5.3 Traffic-related Noise

Benbow (2014a) also used SoundPLAN v7.2 to model the traffic-related noise levels likely to be received at residential receivers adjoining the transport route incorporating the following inputs / assumptions.

- A total of 440 truck movements have been considered when calculating the $L_{Aeq(15\ hour)}$ and 60 truck movements have been considered between a shoulder period of 5:00am and 7:00am (the only period during the night time when transport is proposed). This equates to the maximum number of truck movements anticipated from the Proposal, which would be reached only occasionally (two or three periods) during the life of the Proposal (see Section 2.8.3).
- A shoulder period was applied to the assessment of night time noise, in accordance with guidance provided by the RNP, to more accurately assess road traffic noise during the night time period (which would only occur between the hours of 5:00am and 7:00am).
- Average truck speed of 50km/h. This assumption was applied as Benbow (2014a) believe this to be a reasonable average when considering the hills and curves of Jenolan Caves Road between the Austen Quarry and the Great Western Highway. Furthermore, a reduced average speed will overestimate the predicted traffic noise contribution and is therefore considered conservative.

[9] L_{Aeq} refers to the Equivalent Continuous Level of noise, i.e. it represents the equivalent continuous sound which would contain the same sound energy as generated by noise which varies over time. Therefore, the $L_{Aeq(15\ minute)}$ effectively provides the average noise level over a 15 minute period.

The distance from the façade of relevant residences along Jenolan Caves Road (refer to **Table 4.36**) was again used in the calculation of an equivalent continuous noise level for the daytime ($L_{Aeq(15\ hour)}$) and night time ($L_{Aeq(9\ hour)}$) periods, as well as a maximum ($L_{A(max)}$) noise level for the night time period, for the combined background and Proposal-related traffic.

4.9.5.4 Blasting

Analysis of the results of blast monitoring undertaken throughout the life of the Austen Quarry to date has been used to assess the likely impact of blasting against the criteria nominated in Section 4.9.3.4.

4.9.6 Assessment of Impacts

4.9.6.1 Operational Noise

The predicted noise levels for each scenario under the assessed meteorological conditions for Scenarios 1 to 3 are provided in **Table 4.38** for the 11 representative privately owned residential receptors (see **Figure 4.44**).

It is noted that compliance with the Project Specific Noise Criteria is predicted at all receivers except under temperature inversion conditions for Scenarios 1 and 2 at Receiver R31 and Receiver R48. The maximum predicted exceedance at Receiver R48 is 0.3dB(A) and is considered by Benbow (2014a) to be negligible given the conservative approach to the assessment. The maximum predicted exceedance at Receiver R31 is 1.3dB(A) and in reality unlikely to occur for the following reasons.

- The prediction assumes that a temperature inversion occurs concurrently with wind blowing from the north or northeast. As illustrated by **Figure 4.1**, northerly and northeasterly winds are very infrequent feature of the local setting. The neutral weather condition and wind blowing from northwest condition represent the conditions which will be present for the majority of the time.
- The prediction assumes all equipment and vehicles located within the processing area, extraction area and stockpile area are operating at full capacity and simultaneously. This circumstance is unlikely as from the commencement of Stage 2 Site operation at 6:00am, various inspections, meetings and other activities generally occur such that operation at full capacity is unlikely before 7:00am.

On further analysis of the predicted exceedance at Receiver R31, Benbow (2014a) identifies that the main operational noise contribution would be the drill rig. The Applicant notes that drilling rarely commences before 7:00am (i.e. outside the period when inversions are likely to be at their strongest). Acknowledging the possible exceedance of noise criteria under a combination of inversion and other noise enhancing conditions, the Applicant has committed to undertaking a noise compliance assessment during the first twelve months of operations. This noise compliance assessment would review the operational noise levels at Receiver R31 during periods of early morning drilling. Should non-compliance with criteria be identified, the Applicant would implement an additional restriction on operations with drilling to be prohibited before 8:00am during those months when inversion conditions prevail (nominally March to September). Should further non-compliance with criteria be recorded, alternative measures such as the use of mobile noise barriers, would be considered.

Table 4.38
Predicted Operational Noise Levels

Receiver	Neutral Weather Conditions				Temperature Inversion[1]		Northwest (3m/s) Wind			
	Day	Evening	Night	Night	Night	Night	Day	Evening	Night	Night
	L_{Aeq}			L_{Amax}	L_{Aeq}	L_{Amax}	L_{Aeq}			L_{Amax}
Scenario 1 – Stage A										
R9	<20	<20	<20	35.7	25.6	41.4	25.8	25.8	25.8	41.6
R16	22.0	22.0	22.0	22.3	28.0	28.3	27.9	27.9	27.9	28.3
R22	<20	<20	<20	<20	<20	22.5	<20	<20	<20	<20
R23	24.9	24.9	24.9	36.7	30.7	42.3	<20	<20	<20	29.3
R24A	28.2	28.2	28.2	43.3	34.0	48.7	22.1	22.1	22.1	36.7
R24B	27.4	27.4	27.4	42.8	33.3	48.2	21.3	21.3	21.3	36.2
R27	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
R31	30.5	30.5	30.5	45.2	**36.1**	50.0	31.7	31.7	31.7	46.0
R48	29.5	29.5	29.5	40.3	35.3	45.8	28.6	28.6	28.6	41.4
R49	20.2	20.2	20.2	28.2	26.2	33.5	23.4	23.4	23.4	33.4
R54	29.9	29.9	29.9	35.8	34.7	40.5	32.0	32.0	32.0	33.8
Scenario 2 – Stage C										
R9	20.5	20.5	20.5	35.7	26.6	41.4	26.8	26.8	26.8	41.6
R16	23.9	23.9	23.9	<20	30.1	20.0	30.0	30.0	30.0	20.0
R22	<20	<20	<20	<20	<20	22.5	<20	<20	<20	<20
R23	24.9	24.9	24.9	36.7	30.7	42.3	<20	<20	<20	29.3
R24A	28.1	28.1	28.1	43.3	33.9	48.7	22.0	22.0	22.0	36.7
R24B	27.4	27.4	27.4	42.8	33.2	48.2	21.2	21.2	21.2	36.2
R27	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
R31	30.7	30.7	30.7	45.2	**36.3**	50.0	31.7	31.7	31.7	46.0
R48	29.5	29.5	29.5	40.3	35.2	45.8	28.6	28.6	28.6	41.4
R49	<20	<20	<20	28.2	25.8	33.5	23.2	23.2	23.2	33.4
R54	29.9	29.9	29.9	35.8	34.7	40.5	32.0	32.0	32.0	33.8
Scenario 3 – Stage E										
R9	<20	<20	<20	35.7	20.5	41.4	22.2	22.2	22.2	41.6
R16	<20	<20	<20	<20	23.9	20.0	<20	<20	<20	20.0
R22	<20	<20	<20	<20	<20	22.5	<20	<20	<20	<20
R23	25.1	25.1	25.1	36.7	25.2	42.3	<20	<20	<20	29.3
R24A	27.9	27.9	27.9	43.3	28.1	48.7	21.8	21.8	21.8	36.7
R24B	27.0	27.0	27.0	42.8	27.4	48.2	20.9	20.9	20.9	36.2
R27	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
R31	27.3	27.3	27.3	45.1	30.7	50.0	31.4	31.4	31.4	46.0
R48	29.3	29.3	29.3	40.0	35.0	45.8	28.5	28.5	28.5	41.4
R49	<20	<20	<20	28.2	<20	33.5	22.9	22.9	22.9	33.4
R54	29.9	29.9	29.9	45.2	34.6	40.5	32.0	32.0	32.0	33.8

Note 1: In accordance with the INP, temperature Inversion assessed during night time periods only.

Source: Modified after Benbow (2014a) - Tables 5-3 to 5-5

$L_{A(max)}$ noise levels are not predicted to exceed 46dB(A) at any of the closest receivers considered.

Benbow (2014a) completed a frequency analysis for the predicted noise levels and confirmed that no tonal components or low frequency noise were found at the residential receptors considered.

4.9.6.2 Operational Noise at Vacant Lands

Noise contour maps for each of the vacant lots identified on **Figure 4.44** under each of the operational scenarios are provided as *Figures 5.8* to *Figure 5.19* of Benbow (2014a).

In summary, the predicted noise levels at each of the receptors identified as vacant land did not exceed the Project Specific Noise Criteria levels by more than 15%. Notable results are as follows.

- Exceedance over approximately 8% to 10% of the land at Receptor L17 (Scenario 2).
- Exceedance over approximately 10% to 15% of the land at Receptor L50 (all scenarios).
- Exceedance over approximately 1% of the land at Receptor L32 (Scenario 1).

Noise levels for all other scenarios were within the Project Specific Noise Criteria for 100% of the area. Compliance with the DP&E and EPA applied criteria (see Section 4.9.3.2) would be achieved.

4.9.6.3 Road Traffic Noise

Based on the noise monitoring undertaken at the Locations A and B (see **Figure 4.44**), Benbow (2014a) was able to calculate the existing road traffic noise at five residential receivers between 7m and 1 380m from the road edge. The contribution of traffic noise from the Proposal was also calculated and **Table 4.39** presents the calculated noise level, additional contribution from quarry generated traffic, cumulative road traffic noise levels for the day time and night time periods and maximum noise level for the night time period.

Table 4.39
Predicted Road Traffic Noise Levels

Receiver	Proposal Contribution		Non-Proposal Contribution		Cumulative Road Traffic Noise Levels				Sleep Disturbance L_{Amax}
	Day $L_{Aeq\ (15\ hour)}$	Night $L_{Aeq\ (9\ hour)}$	Day $L_{Aeq\ (15\ hour)}$	Night $L_{Aeq\ (9\ hour)}$	Day $L_{Aeq\ (15\ hour)}$	Increase	Night $L_{Aeq\ (9\ hour)}$	Increase	
R22	35.7	27.9	46.3	36.1	46.7		36.7		64.6
R23	34.2	26.4	44.6	34.5	45.0		35.1		63.1
R24A	57.1	49.3	67.7	57.5	68.1		58.1		86.0
R24B (grassed area)	57.1	49.3	67.7	57.7	67.8	+0.3	58.3	+0.2	86.0
R24B (cottages)	53.0	45.2	63.3	53.4	63.7		54.0		81.9
R48	41.8	34.0	52.2	42.1	52.6		42.7		70.7

Source: Modified after Benbow (2014a) - Table 6-1.

The traffic generated by the Proposal would result in an increase in road traffic noise of only 0.3dB(A) during the day time and 0.2dB(A) at night. Therefore, the Proposal would comply with the total traffic noise criteria where existing road traffic noise is below the criteria (R22, R23 and R48) or relative increase noise criteria where existing road traffic noise is above the criteria (R24A and R24B).

Benbow (2014a) notes that given the proximity of some of the residences to the transport route, most of the vehicles that drive along Jenolan Caves Road would exceed the sleep disturbance criteria with a noise logger placed 10m from Jenolan Caves Road identifying numerous night-time truck movements events with L_{Amax} levels exceeding 55dB(A). Benbow (2014) concludes that elevated L_{Amax} noise levels from vehicle pass-bys are an existing feature of the noise environment for residences adjoining Jenolan Caves Road (and the Great Western Highway) and that the Proposal generated traffic would not add significantly to this.

While the assessment of Benbow (2014a) is considered an accurate reflection of the likely road traffic noise to be generated over the life of the Proposal, road noise was also considered with all 500 truck movements during the daytime period. Notably, over a 15 hour period this would only result in an overall increase of the Hy-Tec-related $L_{Aeq(15hour)}$ road traffic noise level of approximately 0.5dB(A). This is considered to be negligible for the purpose of this assessment considering that the noise contribution from the site-related truck movements is well below the existing road traffic noise levels.

4.9.6.4 Blasting

On the basis that the quarry easily currently complies with air blast overpressure and ground vibration criteria (the blast monitor at Hartley has rarely if ever registered overpressure or vibration), and that blasting will remain consistent with current size and practice, Benbow (2014a) assesses that these levels would continue to readily meet the levels stipulated in EPL 12323.

4.9.7 Monitoring

4.9.7.1 Noise

Based on the recommendation of Benbow (2014a), the Applicant proposes to commission a program of attended noise monitoring within 12 months of approval to validate the predictions of the noise modelling and confirm compliance with operational noise criteria.

On the basis that this illustrates noise levels well below the Project Specific Noise Criteria, it is proposed to only undertake further noise monitoring in response to substantiated noise-related complaint.

4.9.7.2 Blasting

The Applicant proposes to continue to monitor blasts at the long term blast monitoring location in the historic Hartley village.

4.10 AIR QUALITY

4.10.1 Introduction

The DGRs issued for the Proposal identified "Air Quality and Greenhouse Gases" as key issues requiring that the "EIS include a quantitative assessment of the potential:

- *construction and operational impacts, with a particular focus on dust emissions;*
- *dust generation from blasting and processing, as well as diesel emissions;*
- *reasonable and feasible mitigation measures to minimise dust and diesel emissions, including evidence that there are no such measures available other than those proposed; and*
- *monitoring and management measures, in particular real-time air quality monitoring.*
- *Scope 1, 2 and 3 greenhouse gas emissions and the assessment of reasonable and feasible measures to minimise greenhouse gas emissions and ensure energy efficiency.*

Additional matters for consideration in preparing the EIS were also provided in the correspondence attached to the DGRs from the EPA which related to air quality impacts and requested that: *the Proponent must carry out an Air Quality/Odour Assessment and Modelling that addressed:*

- *Point source emissions from plant and equipment and potential impacts.*
- *Fugitive source emissions from exposed areas and other surfaces.*
- *Mitigation and management strategies.*

Also appended to the DGRs is correspondence from DTIRIS requesting detailed information and assessment related to dust impacts and associated mitigation measures.

Based on the risk analysis undertaken for the Proposal (Section 3.3.1 and **Table 3.9**), the potential impacts relating to air quality and their risk rankings (in parenthesis) after the adoption of pre-existing or standard mitigation measures are as follows.

- Nuisance/amenity impacts from dust deposited on window sills, cars, surfaces etc. (medium risk).
- Adverse health impacts (if PM_{10} levels are excessive) (medium risk).
- Increased community and regulatory scrutiny (medium risk).
- Reduced local water quality caused by airborne solids (medium risk).
- Reduced condition of local vegetation or value as fauna habitat (low risk).
- Contribution to greenhouse effect (medium risk).

A review of the attributed risk levels, following the adoption of the recommended operational safeguards and controls, is provided in Section 6.2.1 and **Table 6.1**.

The air quality impact assessment for the Proposal was undertaken by Mr Duke Ismael of Benbow Environmental. The assessment is presented as Part 7 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Benbow (2014b)". This subsection of the EIS provides a summary of the air quality impact assessment, concentrating on those matters raised in the DGRs and related requirements provided by various government agencies. A consolidated list of the identified requirements and where each is addressed is presented in **Appendix 3**.

4.10.2 Background Air Quality

4.10.2.1 Air Emissions

Dust generation is the main air quality issue relevant to the Proposal in terms of air quality. Airborne contaminants that can be inhaled into the human respiratory system are classified on the basis on their physical properties such as being gases, vapours or particulate matter. Particulate matter refers to a category of airborne particulates, typically less than 30 microns (µm) in diameter and ranging down to 0.1µm. This type of dust is termed Total Suspended Particulate (TSP).

Emissions of particulate matter less than 10µm (termed PM_{10}) are considered important pollutants to human health as their ability to penetrate the respiratory system can cause cardiovascular and respiratory diseases, pulmonary and heart diseases, as well as reduced lung capacity.

Particles that are too large to remain in suspension in the air are referred to as 'deposited dust' and are typically in the order of greater than 35µm in diameter. Even though these particles lack the ability to cause significant harm to humans, they can contribute to reductions in amenity and therefore are considered within the assessment, e.g. dust on window sills or cars.

Greenhouse gases would be produced as a consequence of the Proposal primarily through the use of diesel fuel to power generators and mobile equipment on the Stage 2 Site, and fumes from blasting. Greenhouse gases would also be produced indirectly as a consequence of the Proposal through the extraction and processing of raw materials to produce diesel and consumption of diesel by road trucks involved in product transportation.

4.10.2.2 Local Sources

Discounting minor dust and other air emissions from vehicle traffic and other residential-based activities (which are generally short-lived and localised emissions), Benbow (2014b) identifies quarry operations as the only significant source of dust and particulate emissions within the local setting. This conclusion is based on site visits undertaken by Benbow who report in Benbow (2014b) "*the area within proximity to the quarry is considered to show no visible plumes of dust emanating from the quarry or from other sources or activities in the area, nor could large amount of deposits be observed beyond the entrance of the site, which could be attributable to Austen Quarry*".

It is noted that local agricultural activities such as cattle grazing, cultivation, etc. would generate dust. Benbow (2014b) note that these activities would make minimal contribution to the overall particulate matter concentrations of the local setting. These activities have short-lived impacts impacting only a few metres from the source. In contrast, the dust and particulate impacts from the quarry operations are predicted to reach up to hundreds of metres. On this

basis, the magnitude of impact from the quarry will define the overall background dust and particulate concentration at the locations surrounding the Stage 2 Site potentially affected by quarry emissions. As a consequence, Benbow (2014b) has not established background concentrations for the air emissions noted in Section 4.10.2.1, with the assessment to rely on the predicted emissions directly attributable to the Proposal.

Notably and notwithstanding the above, dust deposition monitoring undertaken at three sites to the south and east of the Stage 2 Site since 2003 (see **Figure 4.49**) illustrates relatively low dust deposition levels (see **Table 4.40**).

Table 4.40
Dust Deposition Monitoring Result Summary

	Location[1]								
	AQD-1 Sawmill Paddock			**AQD-2 Baaners Lane**			**AQD-3 Bald Hill**		
Period (July – June)	**Insoluble Solids (g/m^2/month)**	**Ash**		**Insoluble Solids (g/m^2/month)**	**Ash**		**Insoluble Solids (g/m^2/month)**	**Ash**	
		g/m^2/ month	**%**		**g/m^2/ month**	**%**		**g/m^2/ month**	**%**
2003-2004	0.7	0.3	42.2	1.2	0.5	37.6	0.9	0.2	23.3
2004-2005	0.7	0.5	42.6	0.7	0.3	28.2	2.6	1.5	35.6
2005-2006	2.5	1.7	69.5	0.7	0.4	59.4	2.6	1.5	59.1
2006-2007	2.4	0.7	30.7	0.5	0.4	66.0	2.6	2.1	81.4
2007-2008	2.7	1.2	44.4	0.7	0.4	57.1	1.5	0.6	40.0
2008-2009	4.0	0.5	11.6	0.6	0.4	21.2	1.0	0.6	28.6
2009-2010	2.6	1.7	66.1	2.1	1.9	27.3	2.4	2.4	27.0
2010-2011	0.8	0.6	69.6	0.4	0.2	10.6	1.1	0.4	13.6
2011-2012	0.7	0.2	35.0	0.4	0.1	34.7	0.2	0.2	100
2012-2013	1.1	0.4	39.4	0.8	0.3	40.0	0.6	0.2	36.2
Total Average	1.9	0.8	49.2	0.8	0.5	39.9	1.6	1.1	49.4

Note 1: See **Figure 4.49** for gauge locations

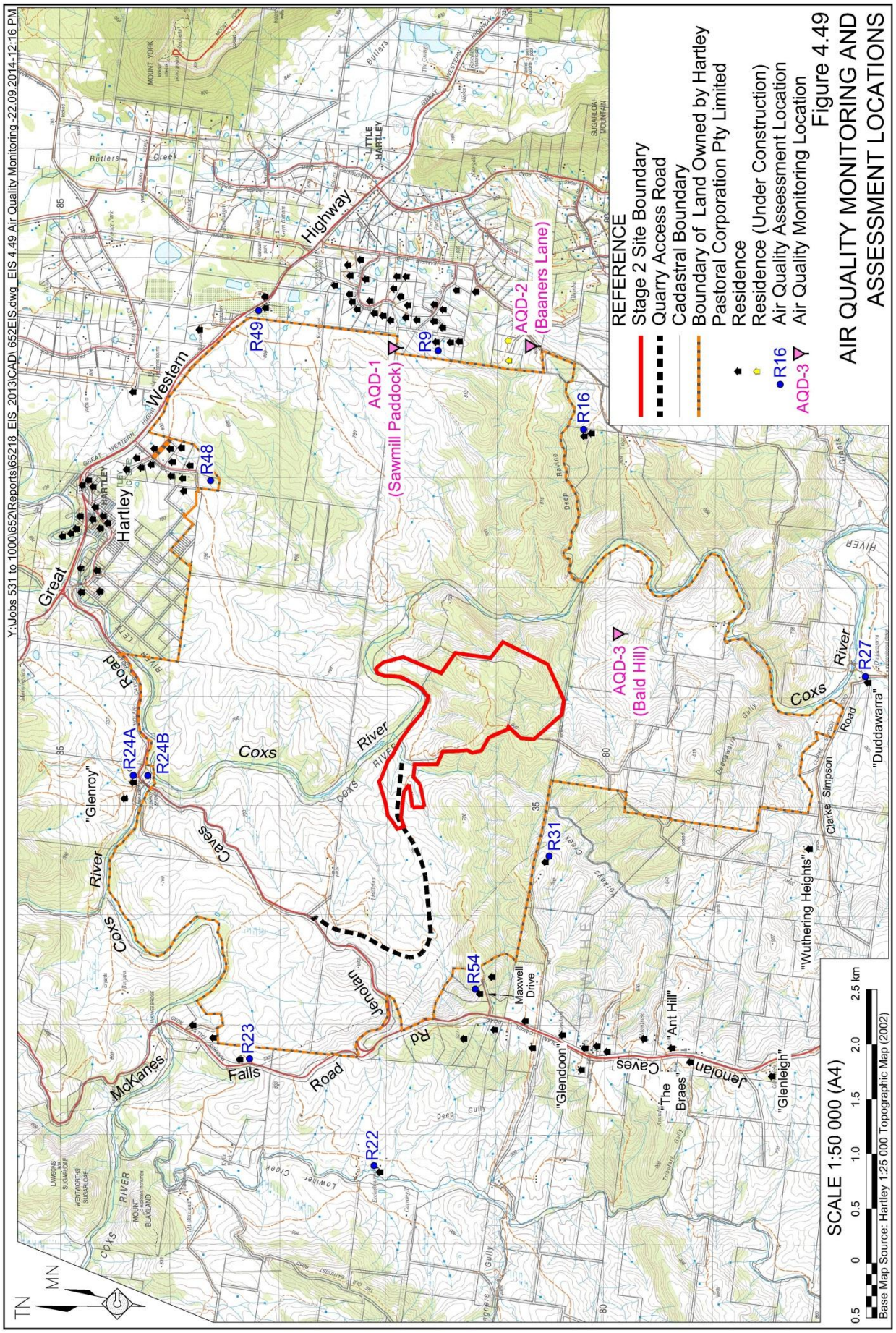
Source: Hy-Tec

4.10.3 Potential Sources of Air Contaminants

4.10.3.1 Particulate Emissions

Activities of the Proposal that would generate particulate emissions are related to the following specific operational and on-site transportation activities.

- Extraction activities (drilling/blasting, excavator, front-end loaders, bulldozers, trucks loading).
- Crushing and screening (dry only).
- Transfer of materials through conveyors.
- Vehicle movements on unsealed roads.
- Product loading and despatch.
- Wind erosion from disturbed areas.


Y:\Jobs 531 to 1000\652\Reports\652018 EIS 2013\CAD\ 652EIS.dwg EIS 4.49 Air Quality Monitoring -22.09.2014-12:16 PM
REFERENCE
Stage 2 Site Boundary
Quarry Access Road
Cadastral Boundary
Boundary of Land Owned by Hartley Pastoral Corporation Pty Limited
Residence
Residence (Under Construction)
Air Quality Assessment Location
Air Quality Monitoring Location
Figure 4.49
AIR QUALITY MONITORING AND ASSESSMENT LOCATIONS
AQD-1 (Sawmill Paddock)
AQD-2 (Baaners Lane)
AQD-3 (Bald Hill)
R9
R16
R22
R23
R24A
R24B
R27
R31
R48
R49
R54
Great Western Highway
Hartley
Great Western Road
Coxs River
Caves Road
Jenolan Caves Road
McKanes Falls Road
Maxwell Drive
"Glenroy"
"Glendoon"
"Ant Hill"
"The Braes"
"Glenleigh"
"Wuthering Heights"
"Duddawarra"
Clarke Simpson
Butlers Creek
Lowther Creek
SCALE 1:50 000 (A4)
0.5 0 0.5 1.0 1.5 2.0 2.5 km
Base Map Source: Hartley 1:25 000 Topographic Map (2002)
TN MN

Attachment 2 of Benbow (2014b) provides an inventory of predicted dust emission from each of these sources (based on various assumptions regarding emission factors, locations and periods of operation or occurrence).

4.10.3.2 Greenhouse Gas and Other Gas Emissions

The primary source of greenhouse gas emissions from the Proposal would be direct emissions as a result of the combustion of diesel by on-site generators and mobile equipment, and also, to a minor extent, emissions from blasting. Greenhouse gases would also be generated indirectly by the Proposal through the extraction and processing of raw materials to produce the diesel fuel consumed on the Stage 2 Site.

Although carbon dioxide (CO_2) would be the principal gas produced, greenhouse gases emitted as a result of the Proposal would also include carbon monoxide (CO), methane (CH_4), oxides of nitrogen (NO_x), SO_2 and non-methane volatile organic compounds (NMVOCs). All greenhouse gas emission levels have been correlated and expressed in CO_2 equivalent units by way of an index entitled the 'Global Warming Potential' (GWP) created by the Intergovernmental Panel on Climate Change (IPCC 1996).

4.10.4 Assessment Criteria

Goals Applicable to PM_{10}

The NSW EPA PM_{10} assessment goals, as expressed in the "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (DEC 2005), are:

- a 24 hour maximum of 50µg/m^3; and
- an annual average of 30µg/m^3.

Goals Applicable to Total Suspended Particles

The annual goal for Total Suspended Particles (TSP), as recommended by the National Health and Medical Research Council (NHMRC), is quoted as 90µg/m^3.

Goals Applicable to $PM_{2.5}$

The ambient Air Quality NEPM was amended in 2003 to extend its coverage to $PM_{2.5}$. This document references the following goals, namely:

- a 24-hour maximum of 25µg/m^3; and
- an annual average of 8µg/m^3.

Goals Applicable to Deposited Dust

The EPA identifies that dust-related nuisance occurs when annual average levels exceed 4g/m^2/month and is subsequently the goal applicable to the Proposal.

As for noise emissions, the DP&E and EPA have historically required air quality criteria be complied with at discrete receivers, e.g. residences, as well as over at least 75% of vacant land with the potential to be developed for the purpose of a residence.

4.10.5 Environmental Controls and Management

The Applicant proposes to continue its mitigation practices that limit the generation of dust from the potential sources of air contaminants identified in Section 4.4.3. Current dust mitigation practices are as follows.

- During periods of extended dry weather and/or high winds, when dust emissions have the potential to occur as a result of quarrying activities, dust is managed through the use of a water truck to supress emissions.
- The primary crushing station is located within the extraction area below surrounding ground level.
- The primary conveyor between the Primary Crushing Station and secondary processing area reduces the distance haul trucks are required to travel.
- Conveyor transfer points are partially enclosed.
- The Quarry Access Road is sealed from Jenolan Caves Road to Yorkeys Creek.
- All other internal roads are surfaced with well graded materials to limit dust lift-off.
- All vehicles travelling on internal unsealed roads are limited to a speed appropriate for the conditions and safety, i.e. less than 40km/hr.
- Load sizes would be limited to ensure product does not extend above truck sidewalls.
- Care would be taken to avoid spillage during loading.
- Dump heights from trucks, front-end loaders and conveyors would be minimised.
- Exposed areas that are not covered in gravel under dry and windy conditions would be watered (visible dust plumes being the trigger for this action).
- As far as practicable, blasts would be scheduled to avoid higher wind conditions, especially when northerly, northwesterly or northeasterly winds prevail (which may result in a plume of particulate matter towards the most affected receiver to the southwest).
- A complaints management system would be adopted to ensure that all complaints are dealt with through investigation and implementation of corrective treatments.
- Truck queuing, unnecessary idling of trucks and unnecessary trips would be reduced through logistical planning, where possible.

The Applicant has and would continue to implement the following measures to minimise the emissions of greenhouse gases during the ongoing life of the Proposal.

- Optimise quarry design to minimise:
  - travel distances for equipment; and
  - rehandling of overburden, products and by-products.
- Use mobile equipment which is regularly maintained and serviced to maximise efficiency.
- Minimise the quarry footprint to reduce land disturbance and travel distances for mobile equipment.
- Optimise the design of the Processing Plant to:
  - maximise the use of gravity to move material throughout the plant reducing the need for pumping; and
  - maximise the use of energy efficient motors in major items of equipment.

As noted above, the use of conveyors to transfer raw materials from the extraction area to secondary processing area reduces the consumption of diesel fuel by haul trucks and therefore greenhouse gas emissions.

4.10.6 Assessment Methodology

4.10.6.1 Particulate Matter Emissions

The overall approach to the assessment undertaken by Benbow (2014b) follows the EPA published guidelines for the assessment of air pollution sources using dispersal methods (DEC 2005). DEC (2005) specifies how assessments based on the use of atmospheric dispersion models should be completed. The atmospheric dispersion modelling conducted by Benbow (2014b) is based on an advanced modelling system using The Air Pollution Model (TAPM) and CALMET/CALPUFF.

The proposed operations were analysed and estimates of dust emissions for the key dust generating activities made by Benbow (2014b)[10]. Emission factors developed both in Australia, and by the US EPA, were applied to estimate the amount of dust produced by each activity. The emission factors applied are considered to be the most reliable, contemporary methods for determining dust generation rates.

The proposed development sequence of the Proposal has been analysed and detailed dust emissions inventories prepared by Benbow (2014b) for the same three operational scenarios used for noise modelling (see **Figures 4.45** to **4.48**). These years are considered to be representative of the various stages of operations throughout the life of the Proposal.

[10] Particulate emissions from Site diesel emissions were not included by Benbow (2014b) as vehicles on the Great Western Highway and Jenolan Caves Road generate far greater diesel emissions. Further, the separation distances of Site diesel emissions from receivers is greater than from road generated sources.

It is noted that while the same operational scenarios have been used for the noise and air quality assessments, some differences in emission sources are noted. These relate to those sources of noise which do not result in air emissions and include the following.

- Water truck. This is a negligible source of dust due to its low speed and the fact it traverses dampened road surfaces.
- Diesel pump. The diesel pump emits no dust and no particulate emissions of any consequence.
- Air separator. This is an enclosed process and has no uncontrolled dust emissions.

Other noise sources identified for various plant operation, e.g. unloading and manoeuvring haul truck, laden and unladen truck, refer to differing noise emissions. Dust emissions are attributed to each item of plant or mobile equipment in accordance with the dust emission inventory.

Dispersion modelling predictions incorporating the generated meteorological model into the CALPUFF dispersion model program for dust deposition, TSP and PM_{10} concentrations were generated by Benbow (2014b) for the 11 representative privately-owned residences identified in **Figure 4.49**.

To assess the impact of the Proposal, the incremental contribution of dust, TSP, PM_{10} and $PM_{2.5}$ predicted at each representative residence was compared against the air quality criteria nominated in Section 4.10.4. Notably, when considering maximum PM_{10} 24 hour emissions Benbow (2014b) adopted two modelling approaches for each of the three operating scenarios.

1. A conservative approach which assumed blasting every day. In doing so, emissions from blasting were considered under the wind conditions of every day of the generated meteorological file.
2. A randomised approach which considers the emissions on only 26 randomly selected days and hours (between 9:00am and 5:00pm). In order to eliminate the bias associated with selecting the number of days throughout the year, the 26 randomly selected days and hours were generated using a computer program through its random number generating module. The emissions were then calculated under the specific wind conditions for that day/hour of the generated meteorological file.

4.10.6.2 Greenhouse Gas Emissions

The World Resources Institute/World Business Council for Sustainable Development 'Greenhouse' Gas Protocol (WRI/WBCSD, 2004) establishes an international standard for accounting and reporting of GHG emissions. The GHG Protocol has been adopted by the International Standard Organisation, endorsed by GHG initiatives (such as the Carbon Disclosure Project) and is compatible with existing GHG trading schemes.

Three 'scopes' of emissions (Scope 1, Scope 2 and Scope 3) are defined for GHG accounting and reporting purposes. Scope 1, or 'direct emissions', refers to those emissions that occur from sources that are owned or controlled by the reporting entity. Scope 2 refers to indirect emissions associated with purchased electricity consumption. Scope 3 refers to those emissions that are a consequence of the operations, but which arise from sources not owned or controlled by the Applicant. Proposal-related GHG sources included in the assessment are as follows.

- Scope 1.
  - On-site diesel use (generators for power to buildings and fixed plant, and consumption by mobile plant).
  - Blasting using ANFO explosive.
- Scope 2: Nil.
- Scope 3: Indirect emissions associated with the extraction and production of diesel.

Inventories of GHG emissions were calculated by Benbow (2014b) using published emission factors. Different gases have different greenhouse warming effects (referred to as global warming potentials) and emission factors take into account the global warming potentials of the gases created during combustion. The estimated emissions are referred to in terms of carbon dioxide equivalent, or CO_2-e, emissions by applying the relevant global warming potential. The greenhouse gas assessment has been conducted using the National Greenhouse Account Factors (NGA Factors) published by the Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE, 2013).

4.10.7 Assessment of Impacts

4.10.7.1 Deposited Dust and Particulate Matter Impacts

Residential Receivers

Tables 4.41 and **4.42** summarise the annual average predicted particulate matter and deposited dust concentrations at 11 representative residential receivers surrounding the Stage 2 Site (see **Figure 4.49**) for the three scenarios noted in Section 4.4.6.1 and illustrated on **Figures 4.45** to **4.48**. **Table 4.41** presents the annual average incremental contribution for PM_{10}, $PM_{2.5}$, TSP of the Proposal and **Table 4.42** presents the maximum 24 hour concentration of PM_{10} and $PM_{2.5}$ received at the 11 representative receivers, under the 365 day and 26 random day models discussed in Section 4.10.6.1.

The results of the dispersion modelling presented in **Table 4.41** illustrate that the emissions attributable to the Proposal would comply with the annual average air quality criteria.

The results of the dispersion modelling presented in **Table 4.42** illustrate maximum 24-hour $PM_{2.5}$ concentrations are all predicted to be well below the nominated criteria.

When considering the 24-hour maximum PM_{10} results, the incremental emission attributable to the Proposal approached the criteria, most notably at Residence R31, where a maximum 24-hour concentration of 35.4µg/m^3, 48.4µg/m^3, and 39.9µg/m^3 was predicted for Scenarios 1, 2 and 3 respectively under the 365 blast days model. On consideration of a more realistic model (considering 26 random blast events), the predicted maximum 24-hour PM_{10} concentration was reduced for all three scenarios to 34.0µg/m^3, 42.8µg/m^3, and 20.4µg/m^3.

Table 4.41
Summary of Annual Average Particulate Matter Concentration

Residence[1]	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	TSP ($\mu g/m^3$)	Dust Deposition (g/m^2/month)
Criteria	***30***	***8***	***90***	***4***
Scenario 1				
R9	4.2	0.41	4.21	<0.01
R16	9.0	0.77	9.01	0.01
R22	3.6	0.14	3.61	<0.01
R23	5.1	0.25	5.11	<0.01
R24A	4.0	0.47	4.08	0.04
R24B	4.0	0.47	4.10	0.05
R27	3.1	0.20	3.11	<0.01
R31	8.6	0.90	8.64	0.02
R48	4.7	0.25	4.71	<0.01
R49	2.6	0.16	2.61	<0.01
R54	11.0	0.38	11.01	0.01
Scenario 2				
R9	0.6	0.43	1.2	<0.01
R16	1.2	0.85	2.4	<0.01
R22	0.2	0.14	0.4	<0.01
R23	0.4	0.25	0.8	<0.01
R24A	0.6	0.47	1.2	0.01
R24B	0.3	0.22	0.6	<0.01
R27	0.6	0.47	1.2	0.01
R31	1.1	0.91	1.2	<0.01
R48	0.3	0.25	0.6	<0.01
R49	0.2	0.16	0.4	<0.01
R54	0.5	0.38	1.0	<0.01
Scenario 3				
R9	0.3	0.45	0.31	<0.01
R16	0.6	0.88	0.61	<0.01
R22	0.2	0.14	0.21	<0.01
R23	0.3	0.25	0.31	<0.01
R24A	0.5	0.49	0.51	0.01
R24B	0.4	0.49	0.41	0.01
R27	0.2	0.21	0.21	<0.01
R31	1.1	0.91	1.11	<0.01
R48	0.2	0.26	0.21	<0.01
R49	0.2	0.17	0.21	<0.01
R54	0.4	0.39	0.41	<0.01

Note 1: See **Figure 4.48** for Representative Residence Locations.

Source: Modified after Benbow (2014b) – Tables 4-5, 4-6 & 4-7.

Table 4.42
Summary of Maximum 24-Hour PM_{10} and $PM_{2.5}$ Concentrations

Residence*	PM_{10} ($\mu g/m^3$)		$PM_{2.5}$ ($\mu g/m^3$)	
Criteria	**50**		**25**	
Blast Days	**365**	**26**	**365**	**26**
Scenario 1				
R9	13.3	18.1	0.73	1.66
R16	28.3	32.4	1.48	1.62
R22	11.4	8.0	0.44	0.90
R23	13.9	20.9	0.68	1.24
R24A	12.4	9.1	0.77	0.01
R24B	12.9	9.6	0.77	0.01
R27	7.3	10.7	0.46	0.06
R31	35.4	34.0	1.58	1.99
R48	12.1	9.5	0.65	0.16
R49	6.6	20.5	0.37	0.08
R54	23.3	12.7	1.33	1.16
Scenario 2				
R9	12.8	16.2	0.73	1.75
R16	25.5	25.5	0.46	2.50
R22	9.3	5.6	0.72	0.66
R23	13.1	23.1	0.76	1.77
R24A	11.8	8.5	0.76	0.06
R24B	11.7	8.4	0.46	0.06
R27	7.5	15.1	0.46	0.09
R31	48.4	42.8	1.63	1.51
R48	12.9	9.7	0.64	0.12
R49	8.5	18.1	0.36	0.11
R54	24.4	13.9	1.33	1.20
Scenario 3				
R9	6.6	11.9	0.78	<0.01
R16	10.9	15.5	1.62	<0.01
R22	6.0	2.8	0.46	<0.01
R23	8.3	16.3	0.7	<0.01
R24A	8.5	5.1	0.79	<0.01
R24B	8.8	5.4	0.79	<0.01
R27	4.0	7.0	0.48	<0.01
R31	39.9	20.4	1.68	<0.01
R48	7.2	7.6	0.66	<0.01
R49	4.2	15.5	0.38	<0.01
R54	18.2	5.8	1.32	<0.01

* See **Figure 4.48** for Representative Residence Locations.

Source: Modified after Benbow (2014b) – Tables 4-9, 4-10 & 4-11.

Notably, no exceedances to the NSW EPA-derived assessment criteria have been predicted, even under the conservative modelling scenarios chosen. The predicted impacts illustrate that blasting is the critical activity on the Stage 2 Site likely to generate elevated PM_{10} emissions at surrounding residences. Due to the low frequency nature of blast events, these are only likely to significantly influence maximum 24-hour concentrations. Benbow (2014b) notes that the actual impact of any blast event would be defined by the wind direction, with winds from the northwest (north and northeast[11]) resulting in elevated PM_{10} concentration at Residences R31 and R16 (the two most affected). When the proportional occurrence of these winds were analysed, these winds were found to represent 45% (see **Figure 4.1**), representing approximately 3 940 hours. Benbow (2014b) note that the second most dominant winds present throughout the year are from the south (a frequency of approximately 17% equating to 1 489 hours) which would reduce the concentration of PM_{10} received at Residences R31 and R16 significantly.

The modelling predictions and additional analyses indicate that through a review of meteorological forecasting, the Applicant would be able to schedule blasts (on most occasions) for periods of emission mitigating wind conditions. Given that both the very conservative 365 day blast model and conservative 26 random blast models predict compliance with criteria, and that the likelihood of blasting coincident with northwesterly winds (which predict the highest PM_{10} concentrations) would be minimised, Benbow (2014b) concludes that sufficient predictive information is provided to indicate future compliance with NSW EPA criteria.

Vacant Land

No vacant land is significantly closer to the air emission sources than the discrete residential receivers assessed. As the predicted emission concentrations at the residential receivers are well below the criteria levels, there is no reason to suggest that emissions would be significantly higher on vacant land of equivalent distance from the sources of emissions.

4.10.7.2 Greenhouse Gas Emissions

The greenhouse gas emissions of the Project have been estimated by considering anticipated activity levels on the Stage 2 Site, standard heat of combustion figures and default emission factors provided in the NGA Factors document (DIICCSRTE, 2013).

Scope 1 Emissions

- **Diesel Usage**

  An average of 840kL and 720kL of diesel would be consumed annually by on-site generators and mobile plant respectively generating 4 209.10t of carbon dioxide equivalents ($CO_{2\text{-}e}$).

- **Explosives**

  Annual use of explosives for blasting has been estimated as 7 200kg of ANFO, generating 1.36t $CO_{2\text{-}e}$.

[11] Combined winds from the north and northeast represent a very small proportion of winds (<5%).

Scope 3 Emissions

- **Diesel Production**

  Based on the quantities of diesel noted above, 319.14t $CO_{2\text{-}e}$ of indirect emissions would be generated from the extraction and production of diesel upstream of the Proposal.

Table 4.43 summarises these calculated greenhouse gas emissions.

Table 4.43
Greenhouse Gas Emissions from the Proposal

Emission Source	Annual Consumption	Emission Factor			Calculated Emissions t CO_{2}-e/annum
		CO_2	CH_4	N_2O	
Scope 1					
Diesel Combustion – Generators	840kL	69.9	0.2	0.5	2 266.44
Diesel Combustion – Mobile Plant	720kL	69.9	0.2	0.5	1 942.66
Explosive Use	7.2t	0.189			1.36
Total Scope 1					4 210.46
Scope 3					
Diesel Production	1 560kL	5.3			319.14
Total Scope 3					319.14
Total					4 529.46
Source: Modified after Benbow (2014b) – Tables 5-1 & 5-2					

The total amount of greenhouse gas emissions from the Proposal is approximately 4 529.5t $CO_{2\text{-}e}$ per annum (0.00412t $CO_{2\text{-}e}$ per tonne of rock product sales). Compared against the 2012 annual estimate for national Australian greenhouse emissions of 551 900 000t $CO_{2\text{-}e}$ (Commonwealth of Australia, 2013), the annual contribution from the Proposal is very small (0.0008%).

4.10.8 Monitoring

The Applicant proposes to continue the program of monthly dust deposition monitoring for the Proposal. The results of all deposited dust monitoring would be documented for the quarry. All results would be included in the Annual Review prepared in compliance with the development consent.

4.11 INDIGENOUS HERITAGE

4.11.1 Introduction

The DGRs issued for the Proposal identified "*Heritage*" as a key issue requiring that the "*EIS include:*

- *an Aboriginal cultural heritage assessment (including both cultural and archaeological significance) which must:*
  - *demonstrate effective consultation with Aboriginal communities in determining and assessing impacts, and developing and selecting mitigation options and measures; and*
  - *outline any proposed impact mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures).*

Additional matters for consideration in preparing the EIS were also provided in the correspondence attached to the DGRs from the OEH which request that "the EIS should contain the following.

- *A description of the Aboriginal objects and declared Aboriginal places located within the area of the proposed development.*
- *A description of the cultural heritage values, and significance of the Aboriginal objects, places and values for the Aboriginal people who have a cultural association with the land.*
- *A description of how the requirements for consultation with Aboriginal people as specified in clause 80C of the National Parks and Wildlife Regulation 2009 have been met.*
- *The views of those Aboriginal people regarding the likely impact of the proposed development on their cultural heritage.*
- *A description of the actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposed activity;*
- *A description of any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places.*
- *A description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm.*

Based on the risk analysis undertaken for the Proposal (Section 3.3.1 and **Table 3.9**), the potential impacts relating to indigenous heritage and their risk rankings (in parenthesis) after the adoption of pre-existing or standard mitigation measures are as follows.

- Damage or destruction of identified Aboriginal artefacts, sites or values (low risk).
- Damage or destruction of not yet identified Aboriginal artefacts, sites or values (low risk).
- Cumulative reduction of the in-situ archaeological record (low risk).

A review of the attributed risk levels, following the adoption of the recommended operational safeguards and controls, is provided in Section 6.2.1 and **Table 6.1**. The indigenous heritage impact assessment for the Proposal was undertaken by Ms Amanda Atkinson of Niche Environment and Heritage. The assessment is presented as Part 8 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Niche (2014b)". This subsection of the EIS provides a summary of the indigenous heritage impact assessment, concentrating on those matters raised in the DGRs and related requirements provided by various government agencies. A consolidated list of the identified requirements and where each is addressed is presented in **Appendix 3**.

4.11.2 Method of Investigation

4.11.2.1 Introduction

For the purposes of the Indigenous Cultural Heritage Assessment undertaken by Niche (2014b), the area of assessment incorporates only the proposed extensions to the extraction and overburden emplacement areas. The remaining areas of the Stage 2 Site remain unchanged from existing operations and are managed under the existing protocols and other management measures established in conjunction with the approval of Stage 1 and the conditions provided in DA 103/94.

4.11.2.2 Consultation

Consultation with Aboriginal stakeholders commenced in July 2013 and continued throughout the preparation of the EIS. All consultation was conducted in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCRs) (DECCW 2010). Letters were sent to the following stakeholders notifying them of the Proposal and requesting that they provide a list of registered Aboriginal stakeholders with an interest in the area.

14 June 2013

- Office of Environment and Heritage (OEH).
- Bathurst Local Aboriginal Land Council (Bathurst LALC).
- The Registrar, National Native Title Tribunal.

2 July 2013

- NTS Corp Limited.
- Office of the Registrar, *Aboriginal Land Rights Act 1983*.
- Hawkesbury-Nepean Catchment Management Authority.
- Lithgow City Council.

Based on the responses received from the above, and the knowledge of Niche of Aboriginal representative groups of the local area, a list of potential stakeholders was compiled and these groups were sent further letters on 11 July 2013 seeking registrations of interest for inclusion in consultation related to the assessment of the Proposal.

An advertisement was published in the *Lithgow Mercury* newspaper on 4 July 2013, in accordance with *Sections 4.12* and *4.13* of the ACHCRs, inviting Aboriginal parties to register an interest in the project.

As a result of the above consultation, the following stakeholders were confirmed as the Registered Aboriginal Parties (RAPs) to the Proposal.

- Bathurst Local Aboriginal Land Council.
- Dhuuluu-Yala Aboriginal Corporation.
- Gundungurra Aboriginal Heritage Association.
- Mingaan Wiradjuri Aboriginal Corporation.
- Tocomwall.
- North East Wiradjuri Company.
- Warrabinga Native Title Claimants.
- Wiradjuri Traditional Owners.

A letter was provided to the RAPs on 21 August 2013 providing the details of a field survey of the proposed extraction area extension. Those parties that confirmed their interest in attending the field survey were provided with an overview of the Proposal and the Stage 2 Site location. The first survey was undertaken on 27 August 2013. Representative of the following RAPs participated.

- Mingaan Wiradjuri Aboriginal Corporation.
- Wiray-dyraa Maying-gu Native Title Group.
- North East Wiradjuri Company.
- Warrabinga Native Title Claimants.

Stakeholders that participated in the field study were asked to provide any shared knowledge or provide comments on Aboriginal cultural values of the Site.

A second field survey was undertaken on 19 November 2013 to assess the proposed Stage 2 overburden emplacement area. Those RAPs who participated in the first survey were invited to participate in the second survey. The following RAPs participated in the second survey.

- Wiray-dyraa Maying-gu Native Title Group.
- North East Wiradjuri Company.

Copies of the draft assessment report were provided to all RAPs in February 2014. No comments relating to the draft report or cultural values have been received.

4.11.2.3 Background Research

Landscape and Historical Context

A review of the landscape and historical occupation of the Stage 2 Site and surrounds was completed to provide a context for the development of a predictive model and assessment of the likelihood of Aboriginal sites or artefacts being present within the Stage 2 Site. The review of the landscape context completed by Niche (2014b) included local soils, geography, topography, flora, fauna and hydrology. The review of the historical context was based on recorded Aboriginal occupation of the area, known tribal boundaries and land use and development after contact with Europeans.

The results of the contextual review are provided in detail in Niche (2014b) and discussed in Section 4.7.3.1 of this document.

Register and Database Searches

A desktop search of registered Aboriginal sites and artefacts within the vicinity of the Stage 2 Site was conducted on 3 June 2013 and 11 June 2013 and included the following registers and databases.

- Australian Heritage Database (which includes places listed in the World Heritage List, National Heritage List, Commonwealth Heritage list, Register of the National Estate and areas that are under consideration).
- Aboriginal Heritage Information Management System (AHIMS) (an area of approximately 5km x 5km centred on the Stage 2 Site).
- NSW State Heritage Register and State Heritage Inventory.
- Lithgow City Council Local Environmental Plan 1994

Archaeological Background

A review of previous archaeological surveys of the area surrounding the Stage 2 Site (including Stockton and Holland, 1974, Mills and Wilkinson, 1993, Australian Museum Business Services, 2002, OzArk, 2003, OzArk, 2004, Comber, 2009, Niche Environment and Heritage, 2012, and Ridgeway, undated) is provided in Niche (2014b). In summary, previous assessments found the landscape surrounding the Stage 2 Site is rich in Indigenous cultural material. Coxs River has also been identified as an important feature for the people living there before European arrival. Excavations undertaken by Stockton and Holland (1974) and OzArk (2003, 2004) have shown the potential for stone artefacts to be present in moderate numbers.

Predictive Model

A predictive model was developed to guide the field surveys given the presence of registered sites within a 5km radius of the Stage 2 Site and to assist with potential visibility issues during the surveys.

A detailed overview of the predictive model is provided in Niche (2014b). In summary, while the Stage 2 Site is located in an area close to a perennial water source that would indicate the presence of camp sites, the moderate to steep sided hill slopes and ridge lines are unsuitable for camp sites and activities associated with these camps. However, towards the lower end of drainage channels, areas of flat ground, rock outcrops or sandstone escarpments, if present, could provide for Indigenous cultural material.

4.11.2.4 Field Surveys

The first field survey of the Stage 2 Site was conducted on 27 August 2013. The survey team consisted of archaeologists Amanda Atkinson and Lydia Sivaraman (Niche), Austen Quarry Manager, Lee Attard, and the RAPs noted in Section 4.7.2.2.

The Stage 2 overburden emplacement area was surveyed separately on 25 November 2013. The entire impact area was surveyed by archaeologist Renée Regal (Niche), Austen Quarry Environmental Manager, Malcolm McDonald, and the RAPs noted in Section 4.11.2.2.

Due to the steep terrain of many of the areas involved in the survey, an opportunistic methodology was used and only accessible areas were surveyed. The survey team was driven along an access track to a ridge top and the extent of the ridge top was traversed until it became too steep to continue. *Figure 11* of Niche (2014b) displays the areas traversed by the field surveys recorded using a non-differential GPS.

4.11.3 Results

4.11.3.1 Results of Background Research

The landscape and historical context of the local area indicate that Aboriginal camp sites are likely to exist based on the readily available food and water resources in the vicinity of Coxs River. In addition, recorded history indicates the presence of several tribal groups in the area at the time of European arrival. However, the steep slopes and ridge lines of the Stage 2 Site indicate little likelihood of Aboriginal sites or artefacts.

The search of the AHIMS database identified 49 previously recorded Aboriginal archaeological sites within the search area (see **Figure 4.50**). This record includes the two open camp sites (artefact scatters) identified by a previous survey of the Austen Quarry (Mills and Wilkinson, 1993)[12]. The dominant site types of the AHIMS record are isolated finds (25 in total) and open camp sites (18 in total). No recorded sites occur within the proposed extension area, however, the two open camp sites (artefact scatters) recorded by Mills and Wilkinson (1003) are located within 500m of the extraction area (see **Figure 4.50**). The presence of the sites listed on AHIMS, including the sites described by Mills and Wilkinson (1993), are consistent with the predictive model prepared by Niche (2014b).

No Indigenous heritage items or sites listed on any of the remaining registers were identified within, or in close proximity to the Stage 2 Site.

4.11.3.2 Results of the Field Survey

Details of the survey coverage and a landform summary are available in Niche (2014b). No Aboriginal objects or places were found during the two field surveys. No cultural values were made known during the field work.

[12] The report prepared by Mills and Wilkinson (1993) recommended that the artefacts be salvaged and displayed in the local NPWS office in Hartley.

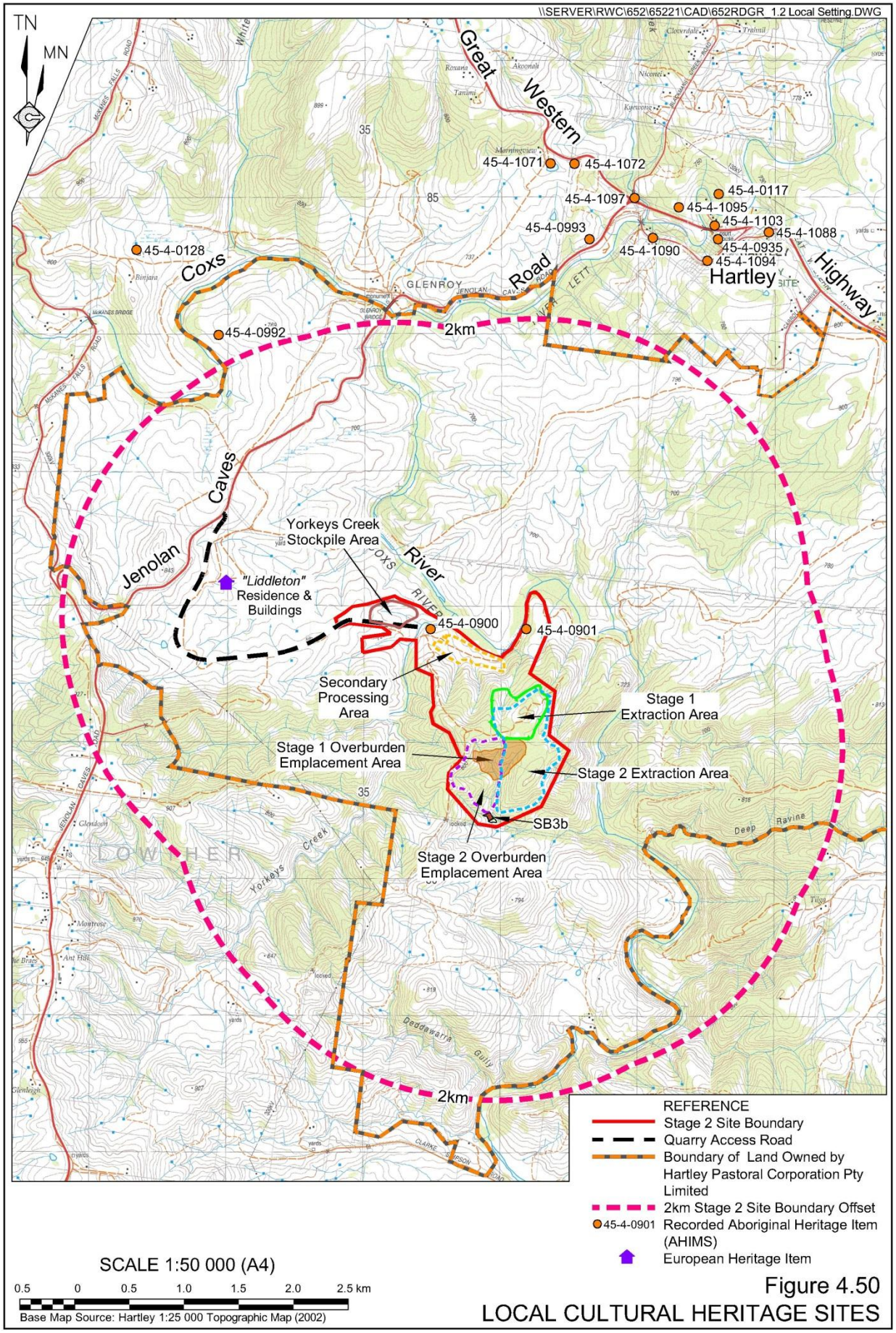


Figure 4.50
LOCAL CULTURAL HERITAGE SITES

4.11.3.3 Significance Assessment

As no items of Indigenous heritage significance were located within the areas to be disturbed, no significance is attributable to these areas in relation to Indigenous heritage values.

The lack of Indigenous heritage significance notwithstanding, Niche (2014b) was issued to the RAPs as a draft for review on the 1 February 2014. No comments on Niche (2014b) or cultural values were received prior to the issue of the final report in September 2014.

4.11.4 Environmental Controls and Management

As a result of the field and background investigations and consultation with the RAPs established for the Proposal, Niche (2014b) confirms that there are no constraints on either cultural or archaeological grounds to the Proposal. However, the Applicant is aware of the possibility of these items occurring unexpectedly, especially given the historical and landscape context of the Stage 2 Site and proximity to the Coxs River. The Applicant is committed to extending the existing management measures that are currently in use and which include the following.

1. Inclusion of Indigenous heritage protocols and obligations within induction processes required to be completed by all staff and sub-contractors prior to commencing work on the Stage 2 Site.
2. A requirement to halt all works in the immediate area if Aboriginal cultural objects are uncovered. The Stage 2 Site procedure then requires contact to be made with a suitably qualified archaeologist and/or Aboriginal community representative to determine the significance of the object(s). The site would be appropriately registered with in the AHIMS (managed by OEH) along with the proposed management outcome for the site. No further work would be undertaken until a management strategy for the site is prepared in consultation with Aboriginal community representative(s), and relevant permits are obtained.
3. A requirement to halt all works in the immediate area if human remains are located during the project to prevent any further impacts to the remains. The NSW Police, the Aboriginal community and OEH would then be notified. If the remains are found to be of Aboriginal origin and the Police consider the site not an investigation site for criminal activities, OEH would be further notified of the situation and works would not resume in the designated area until approval in writing is provided by OEH. In the event that a criminal investigation ensues, works would not to resume in the designated area until approval in writing (has been received) from NSW Police and OEH.
4. All reasonable efforts would be made to avoid impact to Indigenous cultural heritage values at all stages of the development works. If impacts are unavoidable, mitigation measures would be negotiated with the Aboriginal community and OEH.

4.11.5 Assessment of Impacts

Based on the results of the Indigenous Heritage Assessment completed by Niche (2014b), the Proposal, would not impact items or sites of Indigenous cultural heritage value. The proposed management measures would ensure that appropriate care and protection is provided to any sites which may be present and identified at a later stage.

4.12 HISTORIC HERITAGE

4.12.1 Introduction

The DGRs issued for the Proposal identified "*Heritage*" as a key issue requiring that the "*EIS include:*

- *a historic heritage assessment (including archaeology) including a statement of heritage impact (including significance assessment) for any State significant or locally significant historic heritage items and outline any proposed mitigation and management measures*

Based on the risk analysis undertaken for the Proposal (Section 3.3.1 and **Table 3.9**), the potential impacts relating to historic heritage and their risk rankings (in parenthesis) after the adoption of pre-existing or standard mitigation measures are as follows.

- Loss or destruction of items of heritage significance (low risk).

A review of the attributed risk levels, following the adoption of the recommended operational safeguards and controls, is provided in Section 6.2.1 and **Table 6.1**.

The historic heritage impact assessment for the Proposal was undertaken by Ms Amanda Atkinson and Mr Cameron Harvey of Niche Environment and Heritage. The resulting report is presented as Part 9 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Niche (2014c)". This subsection of the EIS provides a summary of the historic heritage impact assessment, concentrating on those matters raised in the DGRs. A consolidated list of the identified requirements and where each is addressed is presented in **Appendix 3**.

4.12.2 Methods

The *Heritage Act 1977* (the Act) is a statutory tool designed to conserve environmental heritage in NSW. It is used to regulate development impacts on the state's historical heritage assets. The Act defines a heritage item as 'a place, building, work, relic, moveable object or precinct'. The Act also distinguishes between items of local and State heritage significance.

To assist with the assessment of the environmental heritage, the *Heritage Manual* 1996 provides guidelines endorsed by the NSW Heritage Council which explain the three steps to manage heritage items in the NSW context. These steps are:

- investigate significance;
- assess significance; and
- manage significance.

To assess the significance of potential historical heritage items located within the Stage 2 Site, a desktop search of heritage listed items was completed, as well as a search of the recorded history of the land on which the Stage 2 Site is located. Finally, a field survey of the Stage 2 Site was completed to provide a physical assessment of the Stage 2 areas for potential items of heritage significance.

4.12.3 Desktop Review

4.12.3.1 Heritage Register Searches

A desktop search of the Stage 2 Site on the following heritage databases was conducted by Niche (2014c) on 3 June 2013.

- Australian Heritage Database (which includes places listed in the World Heritage List, National Heritage List, Commonwealth Heritage list, Register of the National Estate and areas that are under consideration).
- NSW State Heritage Register.
- State Heritage and Conservation Register.
- Lithgow City Council Local Environmental Plan 1994 (Draft Lithgow LEP 2013).

No heritage sites listed on any of these registers were identified within the Stage 2 Site.

4.12.3.2 Stage 2 Site History

A comprehensive review of the history of the land on which the Stage 2 Site is located and the surrounding area is provided in Niche (2014c). The following provides a brief overview of this history.

The Stage 2 Site was located within an historical estate known as 'Liddleton', granted to John Maxwell in May 1832. Despite extensive development of the estate, no known buildings were erected within the Stage 2 Site although as Maxwell was one of the largest pastoral farmers in the area, there is potential for ancillary farming outbuildings, early roads and fencing within his estate. The above notwithstanding, the Stage 2 Site is a small portion of the original 'Liddleton' Estate and so the potential of any historical items associated with the Estate is small.

The 'Liddleton' homestead is still used as a residence and is located on the lower slopes approximately 1km north of the Austen Quarry in the Coxs Valley. It is likely that outbuildings would have been built close to the homestead for ease of access and early roads would most likely be associated with the homestead. Fences may be found on the river flats and lower slopes along the outer edges of the Stage 2 Site. At one time, 'Liddleton' became part of a wildlife refuge before being purchased in July 1978 by the Hartley Pastoral Company. Approval for the Austen Quarry was granted in 1994 with development commencing in 2005 within the Stage 2 Site.

4.12.4 Field Survey

4.12.4.1 Methodology

The field survey for the Proposal was conducted concurrently with the Indigenous heritage field survey on 27 August 2013. The survey team consisted of archaeologists Amanda Atkinson and Lydia Sivaraman (Niche) and Austen Quarry Manager, Lee Attard.

The overburden emplacement area was surveyed separately (and also concurrently with the Indigenous heritage field survey) on 25 November 2013. The entire impact area was surveyed by archaeologist Renée Regal (Niche) and Austen Quarry Environmental Manager, Malcolm McDonald.

Due to the steep terrain of many of the areas involved in the survey, an opportunistic methodology was used and only accessible areas were surveyed. The survey team was driven along an access track to a ridge top and the extent of the ridge top was traversed until it became too steep to continue. Figure 11 of Niche (2014c) displays the areas traversed by the field surveys recorded using a non-differential GPS.

4.12.4.2 Results

No historical heritage items were identified during the field surveys, nor were any areas of archaeological potential for historical heritage items identified.

An extended discussion of the methodology and results of the field surveys is provided in Niche (2014c).

4.12.5 Controls and Management

Although no sites have been identified which would constrain the Proposal, and it appears unlikely that items of historical heritage value would be unexpectedly discovered during the proposed works, the Applicant understands the possibility of this occurring. Existing protocols for the management of heritage items discovered on the Stage 2 Site including reporting obligations under the *Heritage Act 1977* would be maintained should the Proposal be approved. This includes the following procedures.

1. Inclusion of historic heritage protocols and obligations within induction processes required to be completed by all staff and sub-contractors prior to commencing work on the Stage 2 Site.
2. Cessation of works in the immediate area if historic heritage objects are uncovered due to the development activities to prevent any further impacts to the object(s). A suitably qualified archaeologist would be contacted to determine the significance of the object(s). The NSW Heritage Council would subsequently be notified and consulted in developing management strategies
3. Works would not to resume in the designated area until approval in writing has been received from OEH.

4.12.6 Assessment of Impacts

As no items of historical heritage significance were located in the search of heritage databases or in the recorded history of the area, and no items were located in the field surveys of the areas to be disturbed, the Stage 2 Site is assessed to have no significance for historic heritage values.

In the absence of historical heritage items or areas of archaeological potential identified during the assessment, the impact of the proposed extension of Austen Quarry to items or areas of historic heritage will be nil.

4.13 HAZARDS

4.13.1 Introduction

The DGRs issued for the Proposal identified "*Hazards*" as a key issue requiring that the "*EIS address:*

- *potential hazards paying particular attention to public safety, including bushfires.*

On careful review of the local setting, proposed operations and potential for impact on public safety, the following hazards have been identified as relevant to the Proposal and assessed in the following subsections.

- Bush fire. An assessment of the existing bush fire prone land within the Stage 2 Site and surrounds and potential hazard to Stage 2 Site assets and public safety has been completed by RWC (refer to Section 4.13.2).
- Hazardous material management. The identification of the Stage 2 Site as a potentially hazardous industry, as defined by State Environmental Planning Policy 33 – Hazardous and Offensive Development (SEPP 33), has been completed by RWC (refer to Section 4.13.3).
- Traffic Incident. Based on the overall assessment of traffic impacts completed by GTA Consultants Pty Ltd (GTA, 2014) summarised in Section 4.2, RWC has completed an assessment of the hazard to public safety associated with the proposed transport operations of the Proposal (refer to Section 4.13.4).
- Public misadventure. The potential for misadventure on the Stage 2 Site by a member of the public, either an approved visitor or unauthorised entrant, and the controls in place to minimise the risk of such an occurrence has been assessed by RWC (refer to Section 4.13.5).

4.13.2 Bush Fire Hazard

4.13.2.1 Introduction

This bush fire hazard impact assessment for the Proposal was undertaken by Mr Alex Irwin of RWC with assistance from Mr Lee Attard and Mr Darryl Thiedeke of Hy-Tec Industries. Particular attention has been paid to the NSW Rural Fire Service contribution to the DGRs

which requested that the Applicant consider preparing a Fire Emergency Evacuation Plan in accordance with the NSW Rural Fire Service document *Guide for Developing a Bush Fire Emergency Evacuation Plan*.

4.13.2.2 Bush fire Prone Land and Existing Bush fire Hazard

4.13.2.2.1 Bush fire Prone Land

Figure 4.51 identifies the existing bush fire prone land status of the Stage 2 Site and surrounds as nominated in the Lithgow City Council *Bush Fire Prone Land Map* (*Figure 11* of LCC, 2011). The mapping indicates that the Stage 2 Site is currently classed as bush fire prone. The mapping also shows that the bush fire prone land is linked to other areas of bush fire prone land.

Section 79BA of the EP&A Act details the requirement for developments to conform to the specifications and requirements of RFS (2006), however, Subsection (1B) states Section 79BA does not apply to Statement Significant Development. While the requirement for a bush fire assessment in accordance with that document is not required, the procedure detailed in that document has been adopted to identify the potential hazard for the Proposal. Management of the identified hazards are then addressed.

4.13.2.2.2 Bush fire Hazard (Bush fire Attack Category)

In identifying the hazard associated with the bush fire prone land of the Stage 2 Site, the document produced by the Rural Fire Service (RFS) for DP&E entitled "*Planning for Bush Fire Protection*" (RFS, 2006), the updated *Appendix 3* released in 2010, and AS3959.2009 has been used. This requires consideration of various features of the local setting such as the dominant vegetation type(s) within and surrounding the Stage 2 Site, topography and Fire Danger Index (FDI) as follows.

Vegetation Classification

With the exception of the areas disturbed for the purpose of the existing Austen Quarry, and a small cleared area adjacent to the Coxs River to the north of the extraction area, the majority of the Stage 2 Site retains open forest or woodland vegetation (Niche, 2014a). The vegetation has therefore been classified into the following two formations based on the classifications provided in RFS (2006).

- Dry Sclerophyll Forest (open forest) – maximum fuel load of 25t/ha.
- Grasslands – maximum fuel load of 6t/ha

The vegetation to the south and east of the Stage 2 Site, and along the riparian corridor of the Coxs River, is similar to the vegetation occurring within the Stage 2 Site as it is dominated by open forest and grassy woodlands. Cleared land (grasslands) begins to dominate to the west and north of the Stage 2 Site with more isolated patches of forest and woodland present, predominantly along watercourses, elevated land or areas with greater topographic relief.

Slope Classification

Slopes within the Stage 2 Site vary from less than 1:10 (V:H) (6°) in the vicinity of the Coxs River to in excess of 1:3 (V:H) (>18°) on the flanks of the ridge lines that dominate the Stage 2 Site.

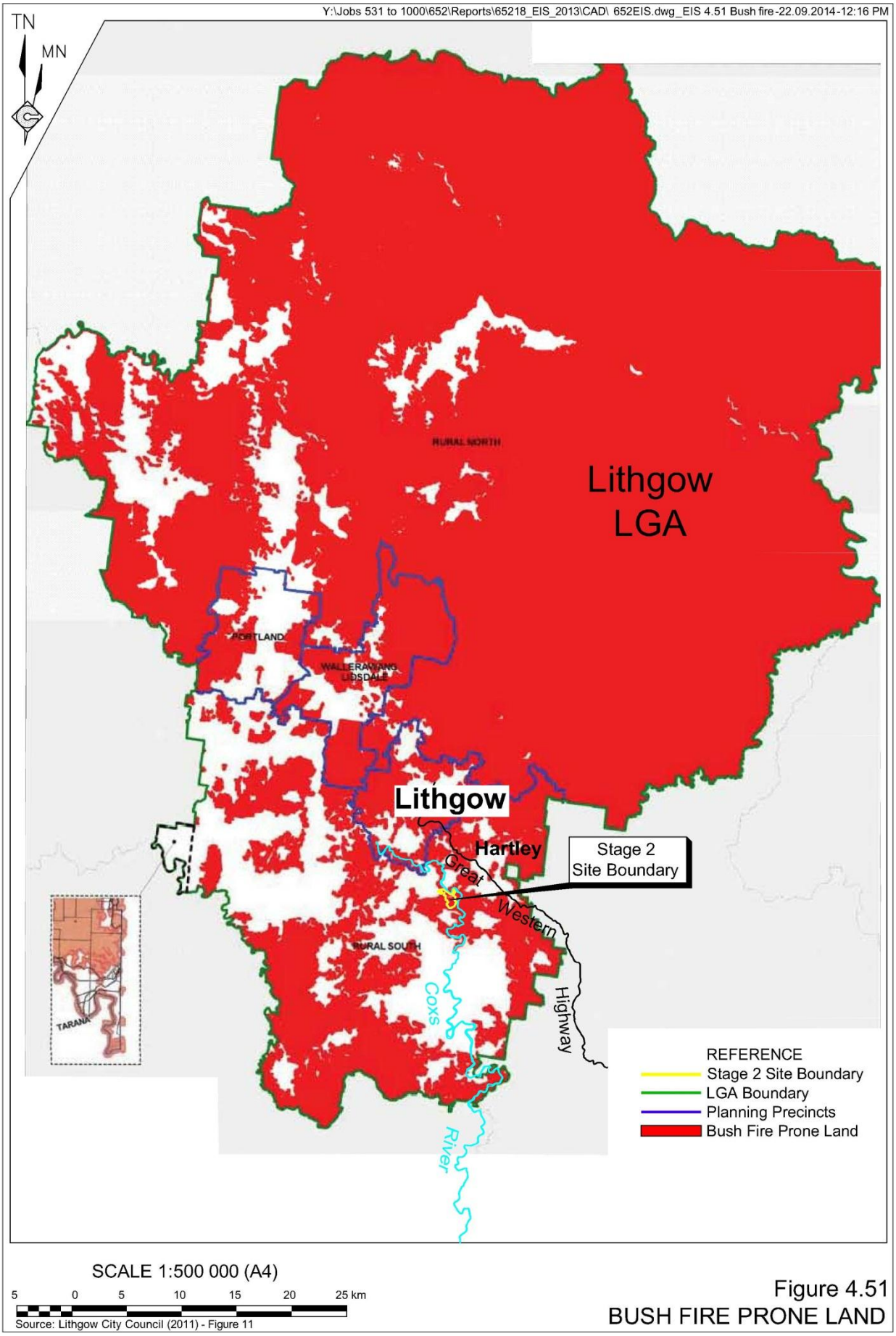


Figure 4.51
BUSH FIRE PRONE LAND

Fire Danger Index (FDI)

Table A2.3 of RFS (2006) nominates Lithgow City LGA as occurring within the Central Ranges NSW Fire Area which is designated a Fire Danger Index (FDI) of 80 for a 1 in 50 year event. This FDI is a number that has been determined by the NSW Rural Fire Service based upon assumed fuel loads within certain geographical regions (usually based upon local government area boundaries). The FDI, a combination of air temperature, relative humidity, wind speed and drought, is used to determine the Fire Danger Rating on a particular day. A FDI of 1 (low-moderate) means that a fire will not burn or will burn so slowly that it can be easily controlled, whereas an FDI of 100 (Catastrophic) means that the fire will burn so fast and hot that it is uncontrollable. An FDI of 80 (Extreme) means that a fire will likely be uncontrollable, unpredictable and fast moving with flames in the tree tops and embers likely to start spot fires up to 6km ahead of the main fire.

Bush fire Attack Category

Table 4.44 provides the bush fire hazard (referred to as the bush fire attack category in RFS, 2006) calculated for activities within 100m of vegetation from a combination of the FDI, vegetation formation, the maximum slope and the proximity of activities to the bush fire hazard. It should be noted that the bush fire hazard assessment takes into account not only the vegetation and associated bush fire hazard within the Stage 2 Site, but also the vegetation immediately surrounding the Stage 2 Site and the general local area.

Table 4.44
Bush Fire Attack Category

Vegetation Classification	Slope	Distance to Activities	Bush fire Attack Category
Dry Sclerophyll Forest (Open Forest)	>15 ° to 20°	20m	Flame Zone
	>10 ° to 15°	20m	Flame Zone
Grassy Woodlands (Woodlands)	>15 ° to 20°	20m	Flame Zone
	>10 ° to 15°	20m	Flame Zone
Grasslands	0 ° to <5°	>100m	Low
Sourced: Based on AS3959.2009			

Activities located further than 100m from the vegetation have a Category of Bush fire Attack classification of "low".

The following descriptions of the predicted bush fire attack and levels of exposure are provided for the Category of Bush Fire Attack (or bush fire hazard) in AS3959.2009.

- BAL-Low. There is insufficient risk to warrant specific construction requirements.
- BAL-FZ. Direct exposure to flames from fire front in addition to heat flux and ember attack.

It is noted that the bush fire attack category, determined in accordance with RFS (2006) and AS3959.2009, relates primarily to building requirements within bush fire prone land. That is, there is no correlation between the bush fire attack category and permissibility of extractive industry on the Stage 2 Site. The categorisation of the activities as being within the flame zone category does, however, illustrate the importance of an effective Fire Emergency Evacuation Plan.

4.13.2.3 Bush fire Management Objectives

The objectives of RFS (2006), considered in this assessment of bush fire management of the Proposal, are to:

- afford occupants of any building adequate protection from exposure to a bush fire;
- provide for a defendable space to be located around buildings;
- provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition;
- ensure that safe operational access and egress for emergency service personnel and residents is available;
- provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the Asset Protection Zone (APZ); and
- ensure that utility services are adequate to meet the needs of fire fighters (and others assisting in bush fire fighting).

4.13.2.4 Safeguards and Controls

4.13.2.4.1 Management Measures

The Applicant would implement the following management and mitigation measures to minimise risks associated with starting bush fires within the Stage 2 Site.

- Ensure refuelling is undertaken within designated fuel bays or within a cleared area of the Stage 2 Site.
- Ensure vehicles are turned off during refuelling.
- Ensure no smoking policy is enforced in designated areas of the Stage 2 Site.
- Ensure fire extinguishers are maintained within all site vehicles and refuelling areas.
- Ensure a focus on housekeeping by all personnel.
- Ensure that a water cart (with suitable pumps and hoses) is available to assist in extinguishing any fire ignited.

Specific measures to manage a local bush fire event would incorporate the following.

- An Outer Protection Area (OPA) of at least 45m would be maintained around the administration centre. The OPA would have the tree and shrub layer removed and a removed or restricted understorey. As defined by *Appendix 2* of RFS (2006), the OPA would reduce the potential length of flames by slowing the rate of spread, filtering embers and reducing the likelihood of crown fire.

- Fuel loads within the OPA would be monitored and reduced as required, i.e. no re-growth of shrub or tree vegetation would be allowed, grass growth would be monitored and cut back as necessary. Specialist advice would be sought, either from the NSW RFS or Lithgow City Council in relation to appropriate fuel load management within the OPA.
- The extraction area access road would be regularly maintained to ensure safe access and egress from the open cut in the event an evacuation is called.
- Water contained within SD1 to SD6, as well as SB1, would be easily accessible for management of ember attack on the buildings of the administration centre or bush fire control generally. Access to this combined 29ML capacity storage would be provided to the NSW RFS in the event of a major bush fire incident in the local area.
- Training (with biennial refresher training) would be provided to site personnel in relation to specific fire fighting tasks and procedures.
- In the event of a local bush fire event, all personnel would be required to assemble at the designated Emergency Assembly Area (car park). A head count would be undertaken to confirm all site personnel and visitors are accounted for. At this time, instructions as to specific procedures to be followed, i.e. site protection or evacuation, would be provided in accordance with the Emergency and Evacuation Management Procedures and advice provided by the NSW RFS.

Notwithstanding the preparation and implementation of the above, the Applicant would ensure that all personnel recognise the authority of the NSW RFS and other emergency services, e.g. NSW Police, and adhere to any and all instructions provided by these authorities. Furthermore, access to all Stage 2 Site facilities and water storages would be provided to the RFS and any reasonable assistance offered.

4.13.2.4.2 Emergency Management

A Bush fire Emergency Evacuation Plan has not been prepared for the Stage 2 Site, however, the information requirements of such a plan, as nominated in *Guide for Developing a Bush Fire Emergency Evacuation Plan* (RFS, 2004), have been compiled (and supplied to the local RFS station in March 2013). The following reviews the 12 steps of a Bush fire Emergency Evacuation Plan.

- Step 1. Introduction.

  Details of the Austen Quarry operation, i.e. location, nearest cross road, number of persons employed and contacts (primary, secondary and after hours), have been compiled and supplied to the RFS.

- Step 2. Background Information on Premises.

  A detailed description of the operations undertaken on the Stage 2 Site, operating plant and equipment, chemicals and dangerous goods maintained on the Stage 2 Site and emergency equipment maintained on the Stage 2 Site have been compiled and supplied to the RFS.

- Step 3. Roles and Responsibilities.

  Stage 2 Site management have provided to the RFS a list of quarry personnel who could be responsible for escorting emergency services from the entrance on Jenolan Caves Road to the appropriate area of the Stage 2 Site.

  The Site Emergency Response Plan, a copy of which has been provided to the RFS, nominates the emergency contact for the Stage 2 Site, first aid personnel, fire wardens and medical practitioner contact.

- Step 4: Consultation with Emergency Services.

  On 13 March 2013, a letter providing the details described in this section was supplied to the local RFS station.

  An Emergency Contacts list has also been prepared for the quarry including, amongst other, contacts for:

  – ambulance, police, fire brigade;
  – State Emergency Service;
  – Lithgow Hospital;
  – Lithgow City Council; and
  – DRE Mines Inspector.

  The Emergency Contacts list also nominates the information to be supplied in the event an emergency call is to be made.

- Step 5: Safe Refuge / Step 6: Transportation.

  No specific safe refuge or specification of transport has been nominated. However, an Emergency Assembly Area has been nominated and given the isolate nature of the Stage 2 Site, this is considered sufficient for the purpose of this aspect of an evacuation plan.

- Step 7: Identifying 'Designated Assembly Points'.

  The Emergency Response Plan for the Stage 2 Site identifies the Emergency Assembly Area (adjacent to the Stage 2 Site car park).

- Step 8: Accounting for Persons.

  No formal procedure for accounting for all occupants on the Stage 2 Site in the event of a bush fire emergency is maintained on the Stage 2 Site, primarily due to the presence of multiple contracted personnel on the Stage 2 Site at any given time. It is noted that all Stage 2 Site personnel are provided with training in the

application of the Emergency Evacuation Procedure for the Stage 2 Site and all visitors to the Stage 2 Site are provided with an induction nominating the Emergency Assembly point and procedure in the event of an emergency.

- Step 9: Contacting Family Members.

  This step is not considered relevant for the nature of the Stage 2 Site involved. Next of kin information is held for all Stage 2 Site personnel, and required to be provided by contractors inducted onto the Stage 2 Site, should contact need to be made.

- Step 10: Security after Evacuating.

  This step is not considered relevant for the nature of the Stage 2 Site involved.

- Step 11: Stage 2 Site Layout.

  The Emergency Response Plan for the Stage 2 Site provides the Stage 2 Site layout including assembly point and first aid station. The RFS has been provided with the details of emergency equipment and infrastructure maintained on the Stage 2 Site.

- Step 12: Statement of Action.

  No formal statements of action have been generated for the Stage 2 Site. However, the Stage 2 Site fire wardens and first aid representatives have been provided with appropriate training and all personnel are required to complete and confirm (by signatory to a register) training on the Stage 2 Site emergency evacuation procedure. This is considered adequate for a Stage 2 Site the size and type of the Austen Quarry.

4.13.2.5 Assessment of Impacts

The Proposal would not result in an increase to the number and type of ignition sources in the local area. It is acknowledged, however, that the Stage 2 Site is located on bush fire prone land (as mapped by LCC, 2011) and has an elevated bush fire attack category (see Section 4.13.2.4.2). The risk of a fire being initiated on the Stage 2 Site and or detrimental impacts on public safety and assets in the event a local bush fire would continue to be minimised through the implementation of the nominated management and mitigation.

4.13.3 Traffic Incident

4.13.3.1 Potential Incident

Road registered heavy vehicles and light vehicles would continue to enter and exit the Stage 2 Site from Jenolan Caves Road, via the Great Western Highway. While it is noted that the Austen Quarry has operated since 2005 without any significant traffic-related incident, there remains the potential for an accident involving a quarry-related vehicle and a vehicle driven by a member of the public. This potential is illustrated by the number of crashes recorded on Jenolan Caves Road between the Great Western Highway (see **Figure 4.11**).

4.13.3.2 Safeguards and Hazard Reduction Strategies

The risk associated with an incident between a Proposal-related vehicle (road registered heavy vehicle or light vehicle) and a vehicle driven by a member of the public would be managed by a combination of route selection, fleet management and driver behaviour.

Route Selection

- Entry and exit to the quarry would continue to be restricted to the Channelised Right (CHR) / Basic Left (BAL) intersection of the Quarry Access Road and Jenolan Caves Road.
- Transportation through the Blue Mountains to Sydney markets would be restricted to the Great Western Highway (delivery to local markets within the Blue Mountains would require the use of local roads).
- For local deliveries of quarry products within the Blue Mountains, the route would be confirmed prior to commencement of deliveries and specific travel requirements (such as speed limiting, scheduling to avoid certain periods) identified and enforced.

Fleet Management and Driver Behaviour

- The Applicant operates a Management Plan for all truck traffic associated with the Austen Quarry providing for safe standard procedures and guidelines for all trucks entering and exiting Austen Quarry.
- The plan details the responsibilities of each staff member or contractor and the specific tasks and required record keeping relevant to trucks on and off site. It also details product despatch routes and any specific travel requirements including speed limiting, where necessary.
- The Applicant operates a Chain of Responsibility System which is a comprehensive and integrated management system that provides a means for dealing with a wide range of health and safety issues such as driving hours, fatigue, mass and dimensions, load restraints, speed, vehicle standards, and the transportation of dangerous goods. The system recognises that all people within the chain of responsibility for transporting aggregates play a role in ensuring the health and safety of workers and the communities through which they travel and provides for:
  - driver training;
  - a Driver Fatigue Manual;
  - a Driver-Vehicle Checklist;
  - random vehicle checks; and
  - signage and delivery dockets.

Emphasising the relative merit of the systems implemented by the Applicant to manage aggregate delivery, the Austen Quarry was awarded the OH&S Practical Innovation Award for the quarry's Driver Vehicle Check procedures at the 2009 Cement Concrete and Aggregates Australia (CCAA) annual awards. The Applicant was further recognised at the CCAA NSW 2013 Environmental Health and Safety Awards with an OH&S Best Performance Award for the Chain of Responsibility: Driver Vehicle Check system.

4.13.3.3 Assessment of Impacts

Risks associated with an incident between a Proposal-related vehicle (road registered heavy vehicle or light vehicle) and a vehicle driven by a member of the public are considered low given the proposed hazard reduction measures and strategies.

4.13.4 Hazardous Materials Management

4.13.4.1 SEPP 33 Risk Screening

Additional matters for consideration in preparing the EIS were also provided in the correspondence attached to the DGRs from the EPA and Lithgow City Council which requested that the EIS identify all hazardous materials, mitigation measures to deal with potential impacts and detail management plans.

In addressing these requests, an assessment as to whether the Proposal would represent a hazardous or potentially hazardous industry under State Environmental Planning Policy (SEPP) 33 has been completed. This section presents a risk screening completed in accordance with "*Hazardous and Offensive Development Application Guidelines Applying, SEPP 33, January 2011*" (DP&E, 2011) to provide a classification of the Proposal under SEPP 33.

Industries or projects determined to be hazardous or potentially hazardous would require the preparation of a Preliminary Hazard Analysis (PHA) in accordance with Clause 12 of SEPP 33. No further assessment under SEPP 33 is required for projects not considered potentially hazardous following a SEPP 33 Risk Assessment.

4.13.4.2 Hazardous Materials on the Stage 2 Site

Hazardous materials are defined within DoP (2011) as substances falling within the classification of the *Australian Code for Transportation of Dangerous Goods by Road and Rail* (Dangerous Goods Code) (NTC, 2011). Based on this definition, the hazardous materials to be stored on the Stage 2 Site, quantities and storage location are summarised in **Table 4.45**.

The Applicant has confirmed that no Class 1 explosives are or would be stored on the Stage 2 Site. As is the current practice, a blasting contractor is responsible for the design, purchase, transport and use of explosives for the purpose of blasting. Section 4.13.4.3 provides a review of the operational safeguards and controls in place to ensure the risk associated with explosives use at the quarry is minimised.

Table 4.45
Hazardous Materials Storage on the Stage 2 Site

Hazardous Material	Classification	Description	Storage Quantity	Storage Location
Diesel Fuel	Class 3 (C1)	Combustible liquids: flashpoint above 61°C but not exceeding 150°C	2 tanks • 31.4kL • 10kL	Self-bunded tanks within bunded and covered fuel bay
Lubricating oils and greases	Class 3 (C2)	Combustible liquids flashpoint above 150°C	• Engine oil: 2 000L in 20L units • Lubricants: various 44 Gallon (205L) drums	Bunded and covered fuel bay
Source: Hy-Tec (pers. comm. L. Attard)				

Transport information for the hazardous materials of the Stage 2 Site is summarised in **Table 4.46**.

Table 4.46
Hazardous Materials Transport to the Stage 2 Site

Hazardous Material	Classification	Threshold		Average No. of Loads per Annum
		Annual	Weekly	
Diesel Fuel	Class 3 (C1)	-	-	48
Ammonium Nitrate	Class 5.1	500	30	18
Source: Hy-Tec				

4.13.4.3 Operational Safeguards and Controls

Hydrocarbons (Class 3)

The diesel fuel, oils and lubricants would continue to be stored within a bunded and covered storage shed. Furthermore, the diesel tanks are self-bunded to reduce the risk of rupture in the event of an incident with a vehicle or mobile plant. Quarry personnel would continue to be provided with instruction as to the correct refuelling, vehicle maintenance and other activities involving these materials to minimise the potential for spillage. Smoking or operation of open flames within and around the storage facility would be strictly prohibited.

Explosives (Class 1)

Ammonium nitrate, for purpose of ANFO explosive, would only be imported to the quarry on the day of blasting and would not be stored on the Stage 2 Site. Transportation of the ammonium nitrate is and would continue to be by a licensed and accredited blast contractor. The Applicant requires that the truck carrying ammonium nitrate is weighed on entry to the quarry, and again on exit, to ensure that all is accounted for and in accordance with blast design. The Applicant also requires that primers and detonators brought to site are counted on arrival and again on exit for the same reason. The Applicant requires that only personnel or contractors with appropriate shot-firing or other certificates for the handling or management of explosives and blasting are involved in blast design and implementation. Finally, the Applicant has prepared a procedure in the event of a misfire or other event requiring a blast be 'slept' over night. In effect, all detonators would be disconnected and access to the area prevented until such time as appropriate measures are taken to confirm safety and initiation of the blast / re-blast.

4.13.4.4 Assessment and Conclusion

As the diesel fuel (Class 3 - C1) and lubricating oils and greases (Class 3 - C2) are not stored adjacent to any other hazardous materials, DP&E (2011) does not require these to be considered further with respect to storage of hazardous materials.

The total annual movements of ammonium nitrate are below the quantity threshold in SEPP 33 and there are no thresholds associated with the transport of combustible liquids (diesel fuel). The Proposal is therefore not considered potentially hazardous with respect to transport.

Based on the risk screening method of DP&E (2011), the Proposal does not represent potentially hazardous industry under SEPP 33.

4.13.5 Public Misadventure

4.13.5.1 Potential Incident(s)

The Stage 2 Site includes many hazards to public safety including mobile equipment, operating plant, voids, high stockpiles, dams and native fauna amongst others. The potential therefore exists for public misadventure incidents such as trips and falls, traffic accident, crush injury, rock fall / strike and/or snake bite.

It is noted that such incidents could occur to both Site personnel, authorised visitors, if not properly informed of risks and appropriate safety measures, and unauthorised entrants to the Stage 2 Site.

4.13.5.2 Safeguards and Hazard Reduction Strategies

Measures would be implemented to ensure the safety of visitors, contractors and employees, as well as ensuring the security of facilities and equipment from unauthorised access. It is the Applicant's policy that each person employed on, or visiting the Stage 2 Site would be provided with a safe and healthy working environment. In order to achieve this, the Applicant would implement a recruitment, induction and training program to:

- ensure compliance with statutory regulations and maintain constant awareness of new and changing regulations;
- require all quarry personnel and visitors to wear / use Personal Protective Equipment relevant to the activities being undertaken or areas being worked in / visited;
- eliminate or control safety and health hazards in the working environment in order to achieve the highest possible standards for occupational safety in the industry;
- ensure the suitability of prospective employees through a structured recruitment procedure;
- provide relevant occupational health and safety information and training to all personnel;
- develop and constantly review safe working practices and job training;

- provide effective emergency arrangements for all on-site personnel, visitors and general public protection;
- maintain good morale and safety awareness through regular employee assessment and counselling; and
- ensure all contractors adopt and maintain Applicant's policy objectives and safety standards at all times.

While unauthorised access to the Stage 2 Site cannot be absolutely prevented, the Applicant would implement the following measures and controls to primarily restrict unauthorised entry and secondarily reduce the risk to any trespasser on the Stage 2 Site.

- Lock the gate on Jenolan Caves Road outside standard operating hours.
- Use of locks on equipment when site personnel are not working on or with this equipment or plant.
- Installation of and maintenance of safety signage around the Stage 2 Site and perimeter fencing, where necessary.
- Instruct all visitors entering and departing the Stage 2 Site to enter the Stage 2 Site office or weighbridge for registration including time of arrival and departure, and an induction, if required.
- Install appropriate controls to ensure that the stability of the open cut, overburden emplacement and stockpiles.

4.13.5.3 Assessment of Impacts

The Applicant has operated the Austen Quarry with few incidents leading to injury demonstrating the effective implementation of the safeguards and hazard reduction strategies nominated in Section 4.13.5.2. Continued application of these safeguards and strategies would maintain the risk of public misadventure incidents on the Stage 2 Site as low as practically achievable.

4.14 AGRICULTURAL RESOURCES

4.14.1 Introduction

The development of extractive industries needs to be balanced with the continued use and preservation of productive agricultural resources. The term 'agricultural resources' is used here to describe the land upon which agriculture is dependent, the water that is used to sustain it and the industry and secondary businesses that develop to directly supply and support agriculture. As the Proposal is for the purposes of an extractive industry, the following assessment of the potential impact of the Proposal on agricultural resources has been based upon the key issues identified by *Agriculture Issues for Extractive Industry Development* prepared by the Resources Planning & Development Unit of the NSW Department of Primary Industries (DPI, 2012b).

4.14.2 Agricultural Planning Principles

The following considers the Proposal in relation to the principles identified in DPI (2012b) for coexistence of sustainable agriculture and extractive industries.

Extractive industry developments are consistent with strategic plans and zone objectives

Development for the purpose of extractive industry is permissible with consent on land zoned Rural (General) 1(a). Furthermore, the Proposal is consistent with the Lithgow Land Use Strategy 2010-2030 (LCC, 2011) insofar as it would enhance the mineral resources industry within the LGA, recognised as a significant contributor to the local economy and social setting, whilst maintaining a large buffer to existing and potential residential / rural residential style development.

It is also noted that the recently exhibited Biophysical Strategic Agricultural Land (BSAL) map covering the Stage 2 Site does not identify the Stage 2 Site or any lands surrounding this as BSAL.

Extractive industry developments are designed and managed to minimise environmental impacts

The assessments completed throughout Section 4 of this document confirm that, with the adoption of the various operational safeguards, controls, management and mitigation measures and impact offsets proposed, the Proposal would be developed in compliance with relevant criteria and with minimal and managed impact on the surrounding environment where specific criteria are absent.

Land use conflicts are minimised, amenity values are protected and the expectations of local communities are managed

The area of the HPC owned property proposed for development of the quarry extension is currently not actively managed for agriculture. As discussed in Section 4.9.4.4, the only potential land use conflict is associated with passive biodiversity conservation, with this suitably mitigated and offset by the proposed rehabilitation program and biodiversity offset strategy.

As assessed in Sections 4.7 and 4.8, the Proposal would result in minimal change to the local noise environment and air quality. While there would continue to be trucks travelling between the Great Western Highway and the quarry, operations would largely continue unnoticed to the majority of land owners and residents surrounding the Stage 2 Site. The visibility of the extraction area and overburden emplacement from lookouts, public roads and private land within the Lithgow City and Blue Mountains City LGAs is noted, however, as discussed in Section 4.4, this impact would be reduced as far as practically possible by the proposed extraction sequence, rehabilitation plans and other methods. Overall, the Proposal would have a limited impact on the amenity of the local setting.

Rehabilitation is undertaken progressively and any permanent changes to productive capacity are clearly justified

Section 2.13 provides a detailed rehabilitation plan for the Stage 2 Site, with the proposed extraction sequence designed to allow for early rehabilitation of the most exposed components of the overburden emplacement. As nominated in Section 4.2.3.3, the land and soil capability of those areas be disturbed is low (Class 6) and the final landform would be returned to an equivalent capability on rehabilitation.

Proposals are clearly justified in a regional context and identify the merits and community benefit of the proposal

The need for hard rock resources produced by the Austen Quarry as a critical component for construction has been discussed in Section 2.2. The relative merit of the Proposal from a socio-economic perspective is considered in further detail in Section 4.15. In summary, however, when considering the minimal impact of the Proposal on the local and regional community against the benefits generated through local employment and provision of important construction materials locally, it is considered the Proposal provides a net socio-economic benefit.

Consider the following potential impacts and identify suitable mitigation responses for the following

- Impacts on agricultural resources.

  The land to be disturbed within the Stage 2 Site has severe limitations for agriculture (Class 6).

- Transport and access changes.

  The Proposal would not result in any changes to local transport or access arrangements.

- Rehabilitation plans.

  As discussed in Section 2.13, the Stage 2 Site would be progressively rehabilitated with land returned to a land capability equivalent to the pre-disturbance environment and an emphasis placed upon a nature conservation land use.

- Consultation with rural stakeholders.

  Section 3.2.2 documents the consultation program undertaken by the Applicant.

- Mitigation and monitoring.

  The various mitigation measures and monitoring strategies of the Proposal are documented throughout Section 4.

4.14.3 Agricultural Resource Impacts

Given the area of additional impact associated with the Proposal is located entirely on land with severe limitations for agriculture (refer to Section 4.9.2.3) which would not result in the removal of any agricultural production, a detailed review of local agricultural resources of the region is not considered necessary.

4.14.4 Water Resources

As the Proposal would not require large volumes of water, with the water required to be drawn from existing licence entitlements, the impact on agricultural production within the region would be negligible and does not require further consideration.

4.14.5 Transport and Access Changes

While the Proposal would continue to require the use of Jenolan Caves Road and the Great Western Highway to transport quarry products, this would not impact on the access of agricultural producers to markets, industry services and infrastructure. Notably, the transport route for quarry products would not impact on Travelling Stock Reserves or require any road closures or realignments.

4.14.6 Rehabilitation Plans

Rehabilitation of the Stage 2 Site has been designed to re-instate pre-disturbance land uses in the form of:

- passive biodiversity conservation with occasional grazing for fuel control over the extraction area, overburden emplacement and secondary processing area; and
- grazing and occasional cropping over the Yorkeys Creek stockpile area.

Section 2.13 describes the proposed rehabilitation of the Stage 2 Site in sufficient detail to demonstrate long-term impacts on surrounding land uses would be minimised and sustainable future land use optimised.

4.14.7 Consultation

Consultation with the adjoining landowners and users has been undertaken (see Section 3.2.2), however, no issues were raised in relation to agricultural resources or production.

4.14.8 Mitigation and Monitoring

As noted above, the Proposal would have minimal impact on agricultural resources and/or production. This notwithstanding, various mitigation measures and monitoring programs to manage the following are provided throughout the EIS.

- Rehabilitation (see Section 2.13).
- Dust generation and dispersal (see Section 4.8.5).
- Erosion and sediment control (see Section 4.10.5).
- Water quality (see Section 4.10.5).
- Bush fire and other hazards (see Section 4.13).

4.14.9 Conclusion

The Proposal would have negligible impact on agricultural resources and production.

4.15 SOCIO-ECONOMIC SETTING

4.15.1 Introduction

The DGRs issued for the Proposal identified "*Socio-Economic*" as a key issue requiring that the "*EIS include:*

- *potential impacts on local and regional communities, including impacts on social amenity;*
- *a detailed description of the measures that would be implemented to minimise the adverse social and economic impacts of the development, including any infrastructure improvements, or contributions and/or voluntary planning agreement or similar mechanism; and*
- *a detailed assessment of the costs and benefits of the development as a whole, and whether it would result in a net benefit for the NSW community.*

Additional matters for consideration in preparing the EIS were also provided in the correspondence attached to the DGRs from the Lithgow City Council which requests that the Applicant consider entering into a Voluntary Planning Agreement with the Lithgow City Council.

Based on the risk analysis undertaken for the Proposal (Section 3.3.1), the potential impacts relating to socio-economic issues and their risk rankings (in parenthesis) after the adoption of pre-existing or standard mitigation measures are as follows.

- A change in local community structure as a result of income disparity (low risk)
- Perceived loss of amenity at local and neighbouring properties resulting in a change in social activities and impact on feelings of wellbeing derived from associated location (medium risk).
- Actual or perceived loss of amenity at local accommodation locations resulting in impacts to the business viability of local tourist related businesses (medium risk).

A review of the attributed risk levels, following the adoption of the recommended operational safeguards and controls, is provided in Section 6.2.1 and **Table 6.1**.

The socio-economic impact assessment for the Proposal was undertaken by Mr Alex Irwin and Mr Nicholas Warren of R.W. Corkery & Co with assistance from Mr Lee Attard and Mr Darryl Thiedeke of Hy-Tec Industries. This subsection of the EIS provides a summary of the socio-economic impact assessment, concentrating on those matters raised in the DGRs and related requirements provided by various government agencies. A consolidated list of the identified requirements and where each is addressed is presented in **Appendix 3**.

4.15.2 The Existing Socio-economic Setting

4.15.2.1 Overview

The Stage 2 Site is located within the Central West of NSW approximately 3.5km south-southwest of the village of Hartley and 10km south of Lithgow and within the Lithgow City Local Government Area (LGA).

Communities surrounding the Stage 2 Site include the following.

- Adjoining Landowners – includes the owners of properties that adjoin the land owned by HPC.
- The Local Community – includes nearby landowners, residents of Hartley Village and Little Hartley who are considered to have an interest in the Proposal due to the proximity of the Austen Quarry to their homes.
- The Lithgow Community – both residents and businesses in the Lithgow LGA including the town of Lithgow and small villages such as Wallerawang, Marrangaroo, Hampton, Portland and Sodwalls.
- The Blue Mountains Community – mostly residents but some businesses that are impacted by the transport of quarry products along the Great Western Highway through the Blue Mountains.

The following subsections include a brief overview of the socio-economic setting in the Lithgow City LGA and the Census-specific State Suburb (SS) of Hartley.

4.15.2.2 Population

Table 4.47 presents the census population data from the ABS 2006 census and ABS 2011 census for the state suburbs of Hartley and Little Hartley, as well as the Lithgow LGA with NSW statistics provided for comparison (ABS 2006; ABS 2011a). It is noted that the population decrease for the state suburb of Hartley is most likely due to a change in the collection areas between 2006 and 2011. The state suburb of Little Hartley was not available as a collection area in the 2006 census (potentially due to the relatively recent residential development of the areas off Coxs River Road and Baaners Lane) but has been included to provide an indication as to the population in this area surrounding the Stage 2 Site. Land use zoning included in the Lithgow City Council *Local Environmental Plan (LEP) 1994* establishes the suburb of Hartley as Rural (General) while the suburb of Little Hartley is zoned as Rural (Small holdings) suggesting that Little Hartley is a housing growth area within the Lithgow LGA. Population growth in the Lithgow City LGA was slightly lower than the State average between the 2006 and the 2011 census.

Table 4.48 presents the ABS 2011 census population statistics for the Hartley State Suburb, Lithgow LGA and NSW, broken down into age groups (ABS 2011a). In summary, both the Hartley SS and Lithgow LGA have a slightly lower proportion of population aged 20-34 which is consistent with an area that does not offer many tertiary study opportunities. It is also of note that both the Lithgow LGA and Hartley SS have a higher proportion (much higher in the case of the Hartley SS) of population aged 45 to 64.

Table 4.47
Population Statistics

	Hartley SS			Little Hartley SS			Lithgow City LGA			NSW		
	2006	2011	%	2006[1]	2011	%	2006	2011	%	2006	2011	%
Total	497	299	-40	NA	536	-	19 756	20 160	2	6 549 177	6 917 658	6
Males	251	167	-33	NA	274	-	10 017	10 290	3	3 228 451	3 408 878	6
Females	246	132	-46	NA	262	-	9 739	9 870	1	3 320 726	3 508 780	6

Note 1: Census data not available for the Little Hartley SS in 2006.

Source: ABS Census 2006 and 2011.

Table 4.48
Age Statistics

Age Bracket	Hartley SS		Lithgow City LGA		NSW	
	No.	%	No.	%	No.	%
Children						
0-4	12	4.0	1 276	6.3	458 736	6.6
5-14	37	12.4	2 495	12.4	873 776	12.6
Studying or Working						
15-19	17	5.7	1 275	6.3	443 416	6.4
20-24	15	5.0	1 104	5.5	449 685	6.5
25-34	18	6.0	1 977	9.8	941 496	13.6
35-44	41	13.7	2 498	12.4	971 626	14.1
45-54	64	21.4	3 025	15.0	950 452	13.8
Approaching Retirement or Retired						
55-64	50	16.7	2 855	14.2	810 290	11.7
65-74	27	9.0	2 117	10.5	541 689	7.8
75-84	12	4.0	1 153	5.7	336 756	4.9
84+	5	1.7	386	1.9	139 735	2.0
Total	**299**		**20 160**		**6 917 657**	

Source: ABS Census 2011.

4.15.2.3 Employment

Table 4.49 presents employment statistics from the ABS 2011 Census for the Hartley SS, Lithgow LGA and NSW (ABS 2011a). These results indicate that Hartley SS has a higher labour force participation rate while Lithgow has a lower rate than the NSW average. The Lithgow LGA unemployment rate was 7.7% at the 2011 Census. This may be the result of the higher than average proportion of the population looking for full time work in the Lithgow LGA. Most recent labour force statistics sourced from the ABS in September 2013 indicate the NSW unemployment rate has fallen to 5.6% (ABS 2013)[13] but gives no indication of the current employment rate in either the Lithgow LGA or Hartley SS.

[13] ABS 2013 6202.0 - Labour Force, Australia

Table 4.49
2011 Employment Statistics

	Hartley SS		Lithgow LGA		NSW	
	No.	**%**	**No.**	**%**	**No.**	**%**
Employed						
Full-time[1]	97	38.2	4 951	30.2	2 007 925	29.0
Part-time	52	20.5	2 553	15.6	939 464	13.6
Employed, away from work[2]	6	2.4	344	2.1	120 121	1.7
Employed, hours not stated	4	1.6	214		70 821	1.0
Total		**159**		**8 062**		**3 138 331**
Unemployed, looking for work						
Full-time work	3	1.9	417	5.2	116 697	3.7
Part-time work	3	1.9	205	2.5	79 829	2.5
Total		**6**		**622**		**196 526**
Labour Force Participation						
Total labour force		165		8 684		3 334 857
Not in labour force		67		8 684		1 933 275
Labour force status not stated		22		6 801		317 017
Total Persons		**254**		**16 385**		**5 585 149**
Labour force participation		**65.0%**		**53.0%**		**59.7%**

Note 1: Employed, worked full-time' is defined as having worked 35 hours or more in all jobs during the week prior to Census Night.

Note 2: Comprises employed persons who did not work any hours in the week prior to Census Night.

Source: ABS Census 2011

4.15.2.4 Industry Employment

Table 4.50 presents industry employment statistics from the 2011 ABS Census for the Hartley SS, Lithgow LGA and NSW (ABS 2011a). The residents within Hartley SS are involved in a range of industries with the two most common being retail trade and education and training followed by transport, postal and warehousing. This is most likely a result of the Hartley SS representing a "dormitory" suburb for employers within the City of Lithgow. Notably, when the Lithgow LGA is considered, the most significant industry is mining (including extractive industries) (which is well above the NSW average), followed by retail and health care (which are both equivalent to NSW average).

The significance of the mining industry (and primary industries in general) is recognised in the Lithgow Land Use Strategy 2010-2030 (LCC, 2011) (refer also to Section 3.2.3.4.2). Not only does this industry provide direct employment within the LGA, it is likely to provide a stimulus to employment levels within the retail and health care sectors. There are no statistics available which segregate employment generated by extractive industries from mining within the Lithgow LGA. While employment generated by extractive industries is expected to only represent a small proportion (<10%), it is worthy of note that employment provided by extractive industries, as opposed to coal or metalliferous mining, tends to be more stable and less subject to fluctuation related to market movements.

Table 4.50
Industry Employment Statistics

Industry	Hartley SS		Lithgow LGA		NSW	
	No.	%	No.	%	No.	%
Agriculture, forestry & fishing	7	4.4	216	2.7	69 576	2.2
Mining	10	6.3	997	12.4	31 186	1.0
Manufacturing	3	1.9	542	6.7	264 865	8.4
Electricity, gas, water & waste services	0	0.0	351	4.4	34 203	1.1
Construction	9	5.6	471	5.8	230 057	7.3
Wholesale trade	3	1.9	157	1.9	138 890	4.4
Retail trade	25	15.6	803	10.0	324 727	10.3
Accommodation & food services	12	7.5	672	8.3	210 380	6.7
Transport, postal & warehousing	19	11.9	464	5.8	155 027	4.9
Information media & telecommunications	0	0.0	51	0.6	72 488	2.3
Financial & insurance services	0	0.0	133	1.6	158 422	5.0
Rental, hiring & real estate services	0	0.0	77	1.0	51 554	1.6
Professional, scientific & technical services	7	4.4	248	3.1	247 295	7.9
Administrative & support services	6	3.8	274	3.4	102 354	3.3
Public administration & safety	9	5.6	682	8.5	192 634	6.1
Education & training	25	15.6	503	6.2	248 951	7.9
Health care & social assistance	16	10.0	885	11.0	364 321	11.6
Arts & recreation services	0	0.0	79	1.0	46 330	1.5
Other services	9	5.6	289	3.6	117 615	3.7
Inadequately described/Not stated	0	0.0	167	2.1	77 455	2.5
Total	**160**		**17 529**		**3 138 330**	

Source: ABS Census 2011

4.15.2.5 Income

A summary of income statistics for the Lithgow LGA and Hartley SS is presented in **Table 4.51** (ABS 2011a). In summary, income statistics for both the Lithgow LGA and Hartley SS are below the NSW average with a household in the Lithgow LGA earning $341 or 28% less than the NSW average. Both areas also have a higher proportion of people in the low income bracket and a lower percentage of people in the high income bracket compared to the NSW average.

Table 4.51
Income Statistics

Income	Hartley SS	Lithgow LGA	NSW
Median individual income ($/weekly)	555	450	561
Median family income ($/weekly)	1 166	1 190	1 477
Median household income ($/weekly)	958	896	1 237
Less than $600 gross weekly income	31.9%	34.7%	24.2%
More than $3,000 gross weekly income	8.5%	7.7%	12.3%
Source: ABS Census 2011.			

4.15.2.6 Housing

Table 4.52 presents a summary of the housing cost statistics for the Hartley SS, Lithgow LGA and NSW (ABS 2011a). The statistics indicate that although housing prices are slightly higher in the Hartley SS, rent in this area is one third of the NSW average. Both housing prices and median rent were lower for the Lithgow LGA. The high proportion of unoccupied private dwellings in Hartley indicates this is a popular area for "weekender" accommodation.

Table 4.52
Household Statistics 2011 Census

	Hartley SS	Lithgow LGA	NSW
Median housing loan repayment ($/monthly)	2 167	1 452	1 993
Median rent ($/weekly)	100	170	300
Dwelling owned outright	51 (46.4%)	3 131 (40.2%)	820 006 (33.2%)
Dwelling owned with mortgage	37 (33.6%)	2 429 (31.2%)	824 293 (33.4%)
Dwelling rented	19 (17.3%)	1 895 (24.3%)	743 050 (30.1%)
Average number of persons per bedroom	1.0	1.1	1.1
Average household size	2.6	2.3	2.6
% Unoccupied private dwellings	31.7%	14.4%	9.7%

The total number of households in the Lithgow LGA and Hartley SS at the time of the 2011 census was 7 787 and 110 respectively. Of these households, both the Lithgow LGA and Hartley SS had a higher proportion of dwellings owned outright and fewer households renting than the NSW average.

4.15.2.7 The Socio-economic Indexes for Areas

The Socio-economic Indexes for Areas (SEIFA) (ABS 2011b), is a suite of four summary measures prepared by the ABS from the 2011 Census information that provide a reference for a given area on issues of advantage, disadvantage, education and opportunity, and finally access to economic resources. For each index, geographic areas in Australia are given a SEIFA number. The ABS defines relative socio-economic advantage or disadvantage in terms of people's access to material and social resources, and their ability to participate in society with the designated numbers indicating how disadvantaged that area is compared with other areas in Australia.

The Lithgow LGA is in the 2nd decile for the index of Relative Socio-economic Disadvantage. In contrast, the nearby Bathurst Regional LGA is in the 6th decile while the Mid-Western Regional LGA is in the 4th decile. This indicates that, relative to the rest of the country, the Lithgow LGA has a high level of disadvantage. The Lithgow LGA was also in the 1st decile for the index of Education and Occupation indicating that the LGA has a high proportion of people without qualifications, without jobs, or with low skilled jobs.

4.15.2.8 Regional Amenity and Tourism

The Stage 2 Site is located beyond the western boundary of the Blue Mountains National Park (which covers an area of 268 987ha). The park covers much of the Blue Mountains and Jenolan Caves. Both areas are within the Greater Blue Mountains World Heritage Area. These areas are popular tourist destinations for both scenic and adventure activities, with the Jenolan Caves, an area of national heritage significance, receiving over 230 000 visitors annually. Traffic counts of the Jenolan Caves Road indicate that the highest levels of use for the tourist areas are during the weekend and therefore at a time when quarry operations are at their lowest. Accurate counts of visitors to the Blue Mountains National Park is not possible, however, it is considered a highly significant tourist destination and natural heritage feature.

Other locally significant tourist, or natural heritage, sites include the following.

Coxs River

From its headwaters at Gardiners Gap, within Ben Bullen State Forest, the Coxs River is a perennial watercourse forming part of the larger Hawkesbury-Nepean catchment and Sydney Drinking Water Catchment. Flowing through the Megalong Valley within the Greater Blue Mountains Area World Heritage Area, the Coxs River provides for fishing, bushwalking and other recreational activities. Adjoining the Stage 2 Site on the northern and eastern boundaries, it is identified as a regionally significant fishing watercourse. While there are no areas in the vicinity of the Stage 2 Site dedicated to fishing, the river remains a significant fish habitat (refer to Section 4.8.3).

Hassans Walls

To the east of Lithgow, the sandstone escarpments rise from the Hartley valley with the most prominent vantage point being Hassans Walls Lookout. While visitation numbers to the Hassans Walls lookout, other lookouts and walking tracks are not available, it is identified as a tourist feature of significance within the Lithgow LGA based on the views provided towards the western escarpment of the Blue Mountains and valleys in between.

Mount York

Located on the western edge of the Blue Mountains escarpment, Mount York is a local tourist destination featuring the Mount York Obelisk and providing a major car park and tourist information. The Mount York Obelisk is a historic feature commemorating Blaxland, Lawson and Wentworth for their crossing of the Blue Mountains in 1813, as well as other historic figures who had assisted in pioneering the route over the Mountains, including Evans, Cox and Macquarie[14]. Mount York also provides the starting or end point for bush walks (largely focussed on the historic passage of Blaxland, Lawson and Wentworth).

[14] http://monumentaustralia.org.au/themes/landscape/settlement/display/22369-mount-york-obelisk

Common features of these and other tourist features of the local setting is the natural heritage which can be viewed or experienced. This can be summarised as providing a regional amenity characterised by quiet rural activities within a larger wilderness which provides the backdrop for both passive and adventure driven activities.

It is noted that the quarry has been operating alongside and with little impact to either regional amenity or tourism since 2005.

4.15.2.9 Community Aspirations

The *Our Place…Our Future Community Strategic Plan 2013-2026* (the Plan) (LCC, 2013) was adopted by Lithgow City Council in late 2013 and describes the community's strategic vision for the LGA. The Plan was developed following extensive community consultation and highlights concerns such as the low level of population growth, ageing population, and the issues of youth leaving the area to seek jobs and tertiary education in other areas. The Plan also highlights several positive developments such as the recent establishment of two university campuses being the Notre Dame Rural Medical Clinic and the University of Western Sydney Outreach Campus.

Broadly, the Plan describes the following key activity areas.

- Caring for Our Community.
- Strengthening Our Economy.
- Developing Our Built Environment.
- Enhancing Our Natural Environment.
- Responsible Governance and Civic Leadership.

4.15.3 Potential Impacts of the Proposal on the Socio-economic Setting

The impact of the Proposal on the socio-economic setting of the local area and region would occur primarily as a consequence of the following.

Employment and Economic Stimulus

The long-term security of operations at the Austen Quarry would provide long-term employment security for up to 20 direct positions (an increase of four from existing operations), as well as indirect employment to truck drivers (many of whom would reside locally). Additional investment in the quarry, in the form of plant upgrades and other general improvements, driven by the long-term security of the Stage 2 Site, would provide additional employment and stimulus to local services.

The flow-on effects from the secure wage stream to quarry personnel would provide stimulus to local retail and other service industries within the Lithgow LGA.

Reduced Amenity of Local and Regional Tourist Attractions

Considered in detail in Section 4.4, the proposed quarry extension would be visible from several tourist attractions, most notably Hassans Walls within the Lithgow LGA and Mount York within the Blue Mountains City LGA. If not managed appropriately, the amenity value of these lookouts could be compromised reducing the visitation experience.

Environmental Emissions Impacting on Lifestyle

Increased emissions of dust and noise, or impacts on local water resources and vegetation, could impact on the lifestyle of local residents who have chosen the local setting for the amenity value described in Section 4.15.2.8.

The Social Impact of Road Transport Through the Blue Mountains

The Applicant acknowledges the concern of residents of the Blue Mountains over road safety and the potential danger posed to residents and businesses adjacent to the Great Western Highway as the quarry product travel through the Blue Mountains. These issues have been discussed in detail in Section 4.3 and it is reiterated that heavy vehicle traffic generated by the Proposal would only represent a small proportion of total heavy vehicle traffic travelling through the Blue Mountains. In terms of social impacts, the presence of trucks in these areas may impact feelings of general well-being and amenity for residents. It is considered unrealistic, however, to suggest that the proportion of heavy vehicle traffic attributable to the Applicant would have any measureable effect on local businesses.

4.15.4 Safeguards and Mitigation Measures

In addition to the mitigation measures and management procedures relating to amenity aspects such as transportation, visibility, noise and air quality described previously in Section 4, the Applicant would implement the following management and mitigation measures to ensure that benefits for the community surrounding the Stage 2 Site arising from the Proposal are maximised and adverse impacts are minimised. Where possible, these measures have been categorised to reflect the particular aspect that would be addressed by each.

Social and Community

- Proactively consult with those residents who may be adversely impacted by the Proposal.
- Continue to engage with local community members through the use of an ‘open door’ policy for any member of the community who wishes to discuss any aspect of the Proposal.
- Form and maintain a Community Consultative Committee (CCC), including representative members of the local community and Lithgow City Council. The CCC would be an important forum for reviewing and discussing environmental monitoring and performance, and discussing possible improvements that could be made to operations to improve environmental (and social) performance.
- Regularly brief the CCC on activities at the Quarry and seek feedback in relation to Proposal-related impacts whether real or perceived. In addition, seek advice in relation to the most appropriate manner in which to provide assistance to the community in an effective, fair and equitable manner.

- Continue to maintain the community complaints response system.
- Continue to encourage employees to be actively engaged in the communities in which they live and provide working arrangements, where practicable, that facilitate such engagement.
- Continue to support community organisations, groups and events, as appropriate, and review any request by a community organisation for support or assistance throughout the life of the Proposal. Evidence of this is provided by the $5 000 donation made by the Applicant in late 2013 to the (LCC) Mayor's Bush fire Appeal.

Responsible Road Use

- Continue to implement the nationally recognised Hy-Tec Chain of Responsibility: Driver Vehicle Check system to preserve, as much as practically possible, the safety of all road users and the communities through which product transport trucks will pass.
- Require each truck driver (and their representative contracting company) to confirm (through signature) understanding as to expectations with respect to:
  - driver compliance with all road laws, and on-site requirements, alertness, driving behaviour, response to other motorists and the use of all relevant equipment e.g. truck covers;
  - compliance of the vehicle with all relevant laws and guidelines with respect to safety checks, noise levels and emissions of them; and
  - acknowledgement and agreement to the Applicant's program of random checks of both the driver's and vehicles records.

Employment and Training

- Continue to give preference when engaging new employees to candidates who live within the Lithgow LGA over candidates with equivalent experience and qualifications based elsewhere.
- Continue to encourage and support participation of locally based employees and contractors in appropriate training or education programs that would provide skills and qualifications that may be of use at the Stage 2 Site (and potentially elsewhere within the extractive, mining or related industries).

Economic Contribution and Development

- Continue to give preference, where practicable, to suppliers of equipment, services or consumables located within the Lithgow LGA.
- Develop and implement a Voluntary Planning Agreement (VPA) to offset any additional costs incurred on Lithgow LGA infrastructure and services as a consequence of the ongoing operations at Austen Quarry.

General

- Continue to adhere to all operating conditions, e.g. restrictions on hours of operation and the required standard of facility.
- Implement the recommendations provided in each of the specialist assessments of the Proposal.

4.15.5 Impact Assessment

4.15.5.1 Regional Socio-economic Considerations

A review of the socio-economic setting for the Lithgow LGA highlights the importance of maintaining employment and encouraging diverse industries and economic growth opportunities for the region. The SEIFA statistics for the area suggest higher than average levels of disadvantage and fewer opportunities for employment and education. This is also evident in the lower than average income levels (see **Table 4.51**) and lower numbers of people aged 25-34 (see **Table 4.48**) which may be considered a key age for people establishing careers, investing in housing and starting families. Conversely, the LGA has a higher proportion of people nearing, or in retirement, commonly indicative of an ageing population.

The above statistics demonstrate the critical importance of employment retention and creation within the Lithgow LGA. As discussed in Section 4.15.2.4 (and **Table 4.50**), the most important industries of employment are mining (including extractive industries), health care and retail trade. Notably, the retail sector and to a lesser extent health care sector, rely on the employment and wealth creation of other sectors. As noted, the mining sector provides the greatest contribution to this within the Lithgow LGA highlighting the continued importance of the mining and extractive industry to the existing economic health of the LGA.

On the basis of the regional significance of employment retention and creation generally, and mining sector specifically within the Lithgow LGA, the Proposal presents as a regionally significant development given it would provide a long-term and secure source of employment (both directly and indirectly) and economic stimulus to other businesses within the LGA. The following subsections evaluate the economic and social impacts of the Proposal in more detail.

4.15.5.2 Evaluation of Economic Impacts

Existing operations at the Austen Quarry support the employment of 16 full time staff at the Stage 2 Site and it is estimated that indirect employment through the contracting of transport operations, maintenance and other supply services provides full time employment for at least 40 additional people. The Applicant also estimates that the quarry's annual contribution to the local economy through wages, purchases, local contractors, suppliers (e.g. diesel fuel) and transport operators exceeds $5 million.

If the Proposal is approved, the Applicant has estimated the need for an additional four personnel and therefore (based on the multiplier established for the existing operation) additional indirect employment for six additional people. The annual contribution through wages, local purchases, and business to local contractors, suppliers and transport operators would also be increased. It is worthy of note that the contribution of the Austen Quarry to the

Lithgow LGA economy is well understood and appreciated by the LCC. Following the receipt of the $5 000 donation to the Mayor's Bush fire Appeal, the Lithgow City Mayor (Councillor Maree Statham) stated "*Hy-Tec run a great business here in the Lithgow area and provide many valuable jobs for local people*" (Lithgow Mercury, 19 December 2013). The Proposal would extend the operational life, and thus the economic benefit, of the quarry from the current end date of 2020 for a further 30 years i.e. until at least 2050.

The extended operational life of the quarry would also benefit complementary local industry, e.g. construction, and feasibility of local infrastructure projects such as roads given the raw materials required for these industries and project would be more easily available and less expensive than if they had to be sourced from outside the region, e.g. Sydney, Bathurst or Orange (East Guyong). The flow-on effect, both economically and socially, of the employment and other benefits derived from such industry and projects would also be significant (if difficult to accurately predict or estimate).

Possible negative economic impacts of the Proposal are considered negligible.

- The distance (buffer) between the quarry and other properties and residences is substantial and therefore, no devaluation of property or house prices can be inferred. In fact, the general contribution economic security and stimulus provided by the Proposal would likely provide a boost for local real estate.
- There would almost certainly not be any drain on local services and infrastructure given the current and proposed future workforce are already resident in the region, i.e. they are already being catered for.
- There would almost certainly be no drain on the labour force available to other industries. The proposed increase in employment is modest and likely to be drawn either from those currently or recently unemployed following workforce reductions in the local coal and power generation industry. The employment statistics of **Tables 4.49** and **4.50** support the fact that there is currently ample capacity within the local labour market (high unemployment) from appropriate industry (high proportional representation of employment in mining and other industry with equivalent skill requirements).

4.15.5.3 Evaluation of Social Impacts

The Proposal would not substantially alter the method of extraction, extraction equipment, extraction or processing rates, employment levels (modest increase), product transportation levels (moderate increase to currently approved levels) or general environmental management strategies employed at the quarry. Generally, the principal impacts of the Proposal would be the sustained higher levels of extraction and the lengthening of the life of the Quarry. As such, the potential social impacts would generally be similar to those currently experienced by the communities of Hartley, Little Hartley, Lithgow and surrounding areas which overall are comparatively well accepted in the local community. The ongoing direct and indirect employment provided by the quarry would contribute to underpinning maintenance of social values both locally and regionally.

The Proposal would also contribute to meeting the goals of the Lithgow Council's *Our Place…Our Future Community Strategic Plan 2013-2026* by assisting to strengthen the economy of the local area and providing a local source for the raw materials required for the further develop the built environment.

As noted in Section 4.15.3, it is acknowledged that the Proposal could have some adverse impacts associated with reduced amenity ("lifestyle") of the local setting associated with possible emissions, increased visibility and product transportation through the Blue Mountains. These concerns are illustrated by the feedback provided by local community groups when consulted by the Applicant (see Section 3.2.2.5.1). Each area of potential impact is considered as follows.

- Emissions and other physical impacts of the Proposal.

  Notably, the proposed extension would not change the method or scale of operations at the Stage 2 Site significantly, with existing operations either well accepted or even unknown to adjoining land owners and the local community. The results of air and noise modelling emphasise the very limited impact the Proposal would have, with other assessment of impacts on water resources, local biodiversity and heritage demonstrating minimal and acceptable levels of impact.

  On the basis of the above, the likely impact on amenity as a consequence of Stage 2 Site emissions and other physical impacts would be very minor.

- Increased visibility and impacts on regional amenity and tourism.

  The Stage 2 Site is currently visible from several regionally significant lookouts.

  From Hassans Walls within the Lithgow LGA, modifications to the design and sequence of the extraction area would ensure that the view of the Stage 2 Site does not change significantly over the life of the Proposal (see **Figure 4.25** and **4.27**). From Mount York, the area of visible extraction activities would increase, however, the exposed area would be reduced as far as practicable as a result of modifications to the design and sequence of the extraction area (see **Figure 4.26** and **4.27**). In both cases, additional mitigation measures such as application of a bituminous coat and progressive rehabilitation would further reduce the visible intrusion of the Stage 2 Site from these lookouts.

  Acknowledging that the Stage 2 Site is currently visible from these locations, it is assessed that the changes to the visual outlook from these and other lookouts would not be so significant as to create a major change to the amenity of these points and of the region more generally. Specifically, it is considered highly unlikely that the small changes to visibility would result in discouragement of visitors to these locations or to the wider Lithgow and Blue Mountains areas more generally. As a consequence, any small modifications to regional amenity would not be so significant as to impact on local tourism and affect any social changes as a result.

- Increased visibility and impacts on landowner amenity.

  The Stage 2 Site is currently visible from a number of residential vantage and other publicly accessible vantage points (see Section 4.4.2.3). Sections 4.4.3 to 4.4.5 review the likely changes to visual amenity, proposed design and management measures to be implemented to reduce or mitigate impacts and residual visual impacts of the Proposal.

  The residual visual impacts from vantage points to the northwest (Jenolan Caves Road and McKanes Falls Road) would be gradually reduced as the material currently maintained within the Yorkeys Creek stockpile area is sold and removed from the Stage 2 Site. In the interim, the Applicant has committed to undertaking various visual mitigation trials described in Section 4.4.4.3.

  The residual impacts from vantage points to the north, northeast and east of the Stage 2 Site (Great Western Highway, Bells Line of Road, Blackmans Creek Road, Hartley and Little Hartley) would be effectively managed through the measures to be implemented to reduce the impacts on visual amenity at Hassans Walls and Mt York.

  To the south of the Stage 2 Site (Coxs River Road and Kanimbla) the proposed extraction area and overburden emplacement extension would become more visible following the removal of the Southern Ridge (see **Figure 4.27**). The impact would be partially mitigated given the significant distance between the various private vantage points and the Stage 2 Site (6km). Progressive rehabilitation would also reduce the impact as over a 6km distance, revegetation of the completed overburden emplacement and extraction area benches would significantly reduce the visibility of these.

- Social impact of road transport through the Blue Mountains.

  On the basis that the heavy vehicle traffic generated by the Proposal represents only a small proportion of heavy vehicle traffic through the Blue Mountains and the enforcement of high vehicle and driver performance standards, the Proposal would have an imperceptible impact on the traffic environment of the Great Western Highway. On this basis, it is assessed that there would not be any changes to the amenity of those communities located adjacent to the highway and certainly no impact on the businesses operated.

4.15.5.4 Conclusion

Overall, the Proposal has, to the extent feasible, been designed to minimise the social and economic cost on adjoining land owners, local and regional communities. The Proposal provides for the removal, processing and despatch of products important for the continued growth and prosperity of NSW (see Section 2.2). The Proposal would be significant in maintaining and generating local employment opportunities and continue to provide stimulus to the economy of the Lithgow LGA.

Through an effective consultation program and planning process, the potential socio-economic impacts of the Proposal are well understood and this has allowed the Applicant to design the proposed extension in such a way as to reduce the residual impacts on the local environment and amenity as far as reasonably possible.

The Applicant contends that any adverse socio-economic or environmental impacts, both actual and perceived, would be more than adequately countered by the positive effect that the Proposal would have on the community and economy in the vicinity of the Stage 2 Site and the wider area as it would:

- provide ongoing employment opportunities and contribute to the continued economic activity of the Lithgow LGA;
- contribute towards the supply of aggregate, sand and road building materials important to both regional and NSW construction industries and infrastructure projects;
- contribute towards LCC achieving the objectives of *Our Place…Our Future Community Strategic Plan 2013-2026* by assisting to strengthen the economy of the local area and providing a local source for the raw materials required for the further develop the built environment;
- satisfy ecologically sustainable development principles (refer to Section 6.2.2); and
- have manageable impacts on the biophysical environment and regional amenity values.

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